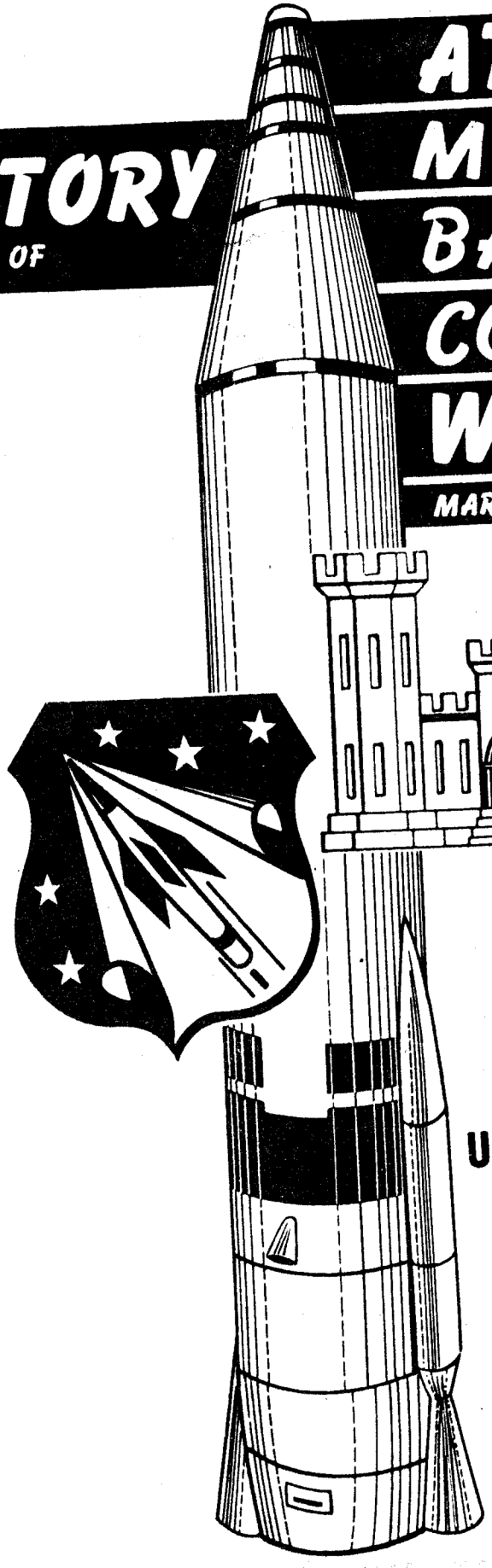
XVIII-13-SB

HISTORY OF ATLAS MISSILE BASE CONSTRUCTION WARREN II

MARCH 1959 - JULY 1960



BY
CORPS OF ENGINEERS
U. S. ARMY ENGINEER DISTRICT
OMAHA

FOR

U. S. AIR FORCE

HISTORICAL SUMMARY REPORT

OF

MAJOR ICBM CONSTRUCTION

Prepared by

T. A. Coffey

and

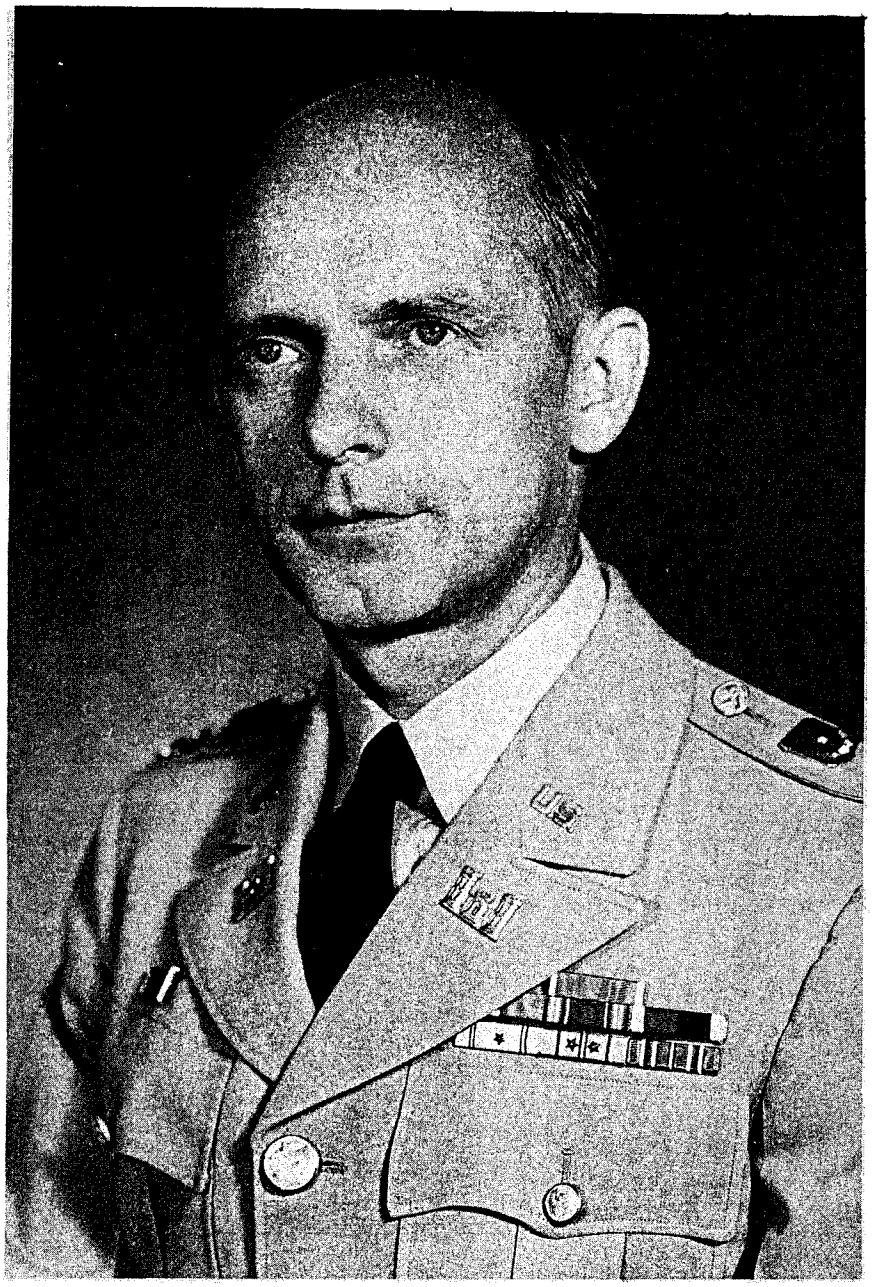
M. A. BADTKE

APPROVED BY:

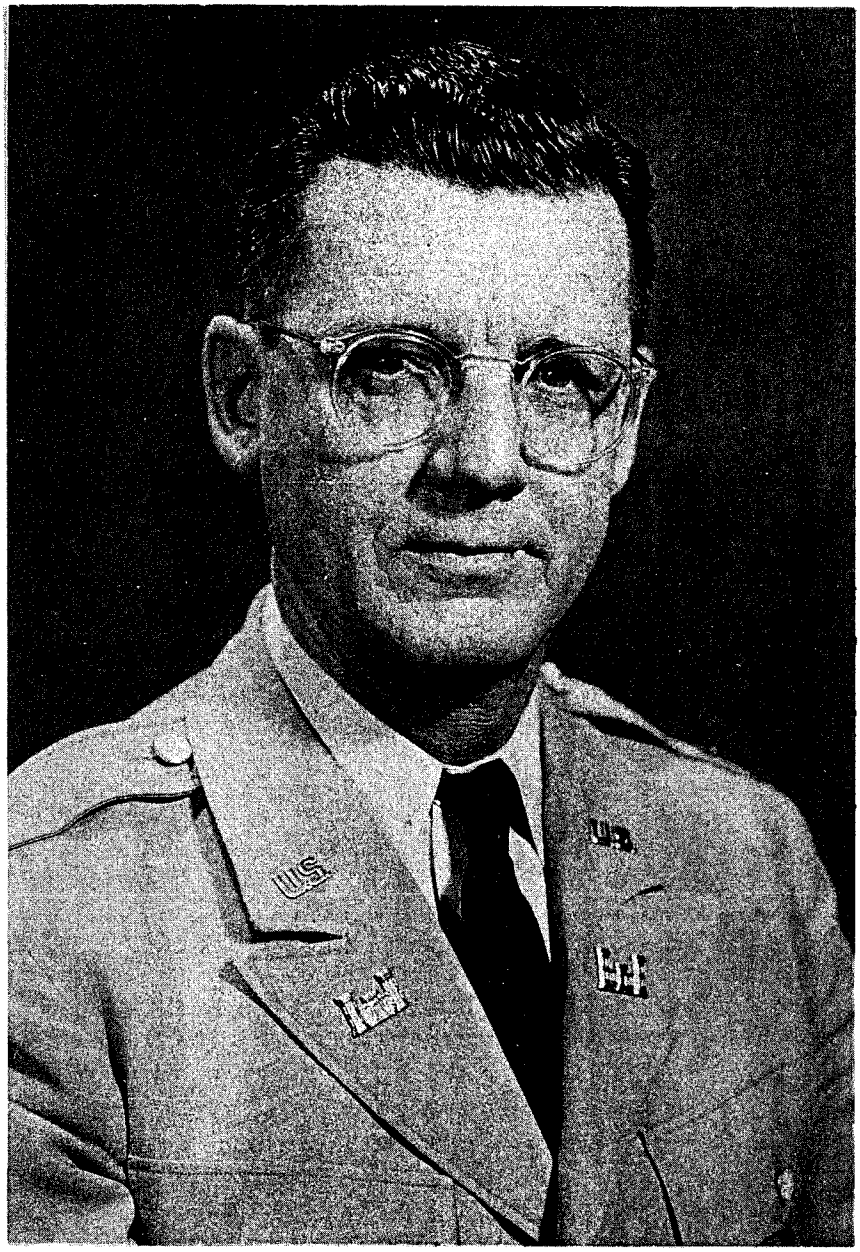
L. L. Price

Chief, Construction Division

FOR OFFICIAL USE ONLY

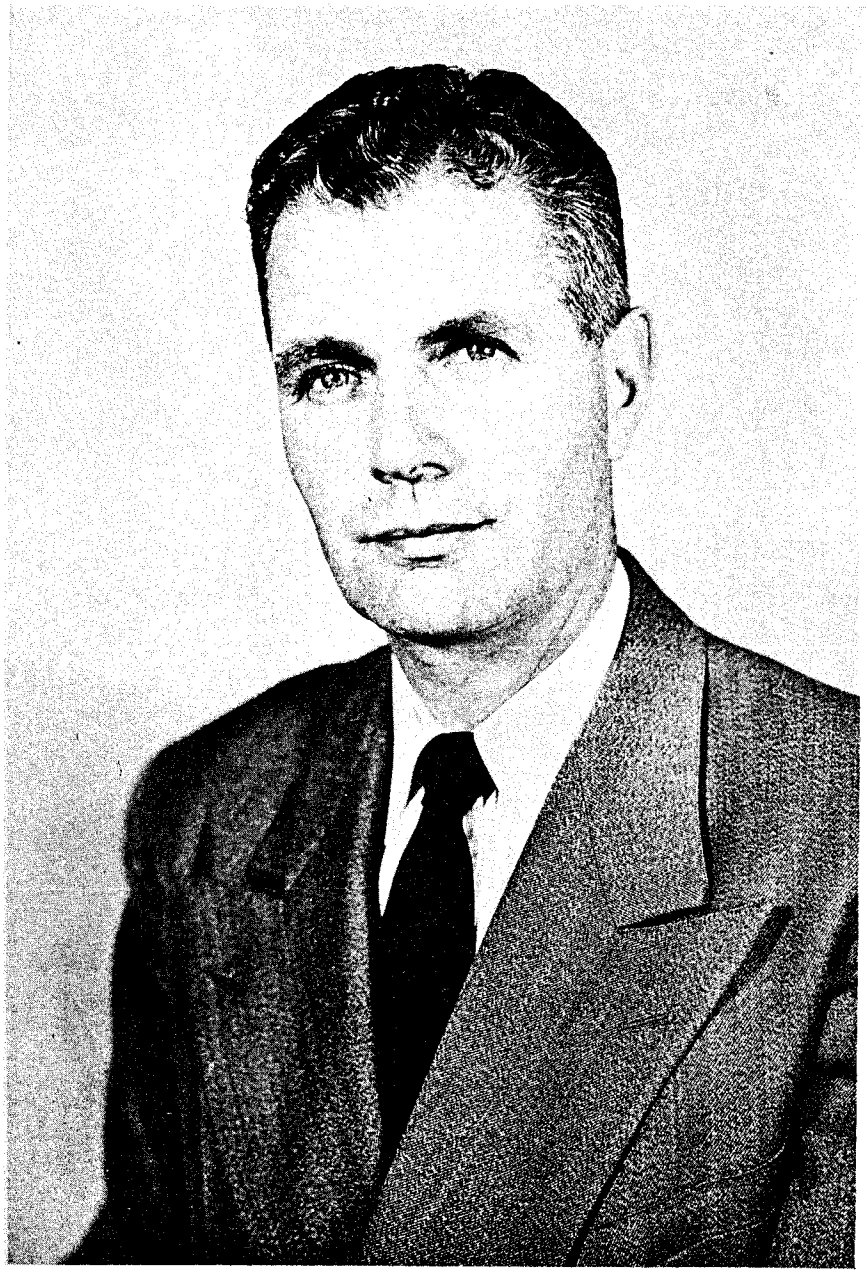


Colonel David G. Hammond
Omaha District Engineer
3 August 1957 - 15 July 1960



Colonel Sidney Martin

Cheyenne Area Engineer
30 June 1958 - 12 July 1961



Joseph C. Patterson

Acting Area Engineer 30 May 1958 - 30 June 1958
Assistant Area Engineer 1 July 1958 - 2 Oct 1960

WARREN II

INDEX

SECTION I

DESCRIPTION OF PROJECT

ICBM FACILITIES, F. E. WARREN AIR FORCE BASE

SQUADRON II

The Squadron II Launch Facilities are of the soft (above ground) type built on a 3 x 3 concept with three launchers built at each of three sites, (identified as B, C, and D on the site location map). In addition to the Launchers each site contains a combination launch operations and guidance building, a power plant, a microwave building, a re-entry vehicle storage facility and gatehouse.

The first contracts awarded were three (3) contracts for procurement of Diesel Engine Generator Sets. These contracts were awarded on 9 February 1959. The last contract awarded was on 26 April 1961 for Miscellaneous Facility Changes. A total of seventeen (17) contracts were awarded during the life of this project. The estimated total final cost of this squadron is $31,488,901.14. A complete itemization of costs is to be found in Section V, "Contracts".

LAUNCH FACILITIES & UTILITIES, SQUADRON II:

Locations: The sites of the work are located as follows:

1. Site B is approximately 22 miles northeast of Cheyenne, Wyoming.

2. Site C is approximately 22 miles east and south of Cheyenne, Wyoming.

3. Site D is approximately 23 miles west and south of Cheyenne, Wyoming.

The principal features of the work are as follows:

1. Three gatehouses, 3 launch operations buildings, 9 launch and service buildings, 3 power and pump houses, 4 well pumping stations, and all appurtenances.

2. Process piping systems and vessels.

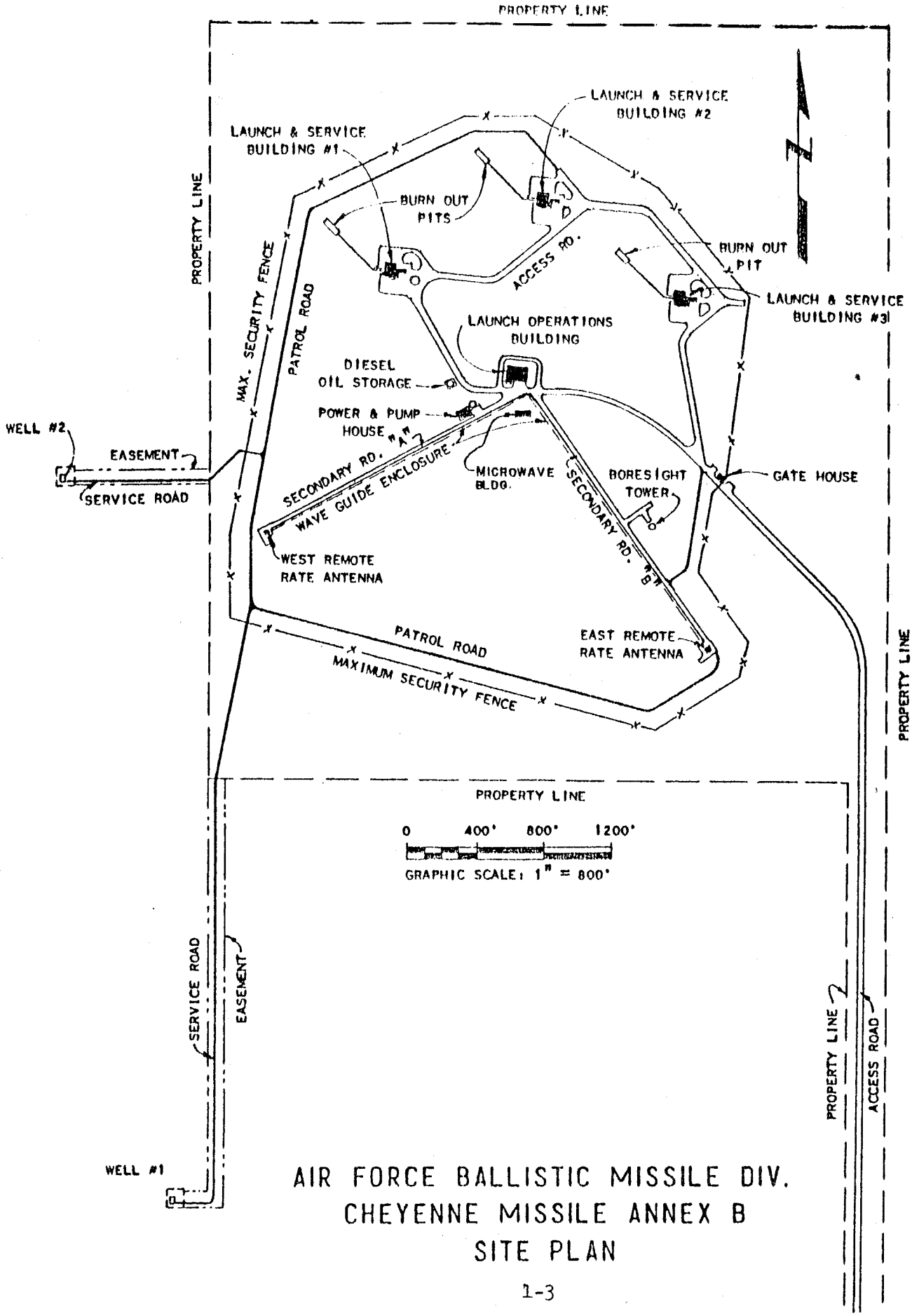
3. Boresight tower foundations and erections.

4. Utility and control lines, ducts and appurtenances.

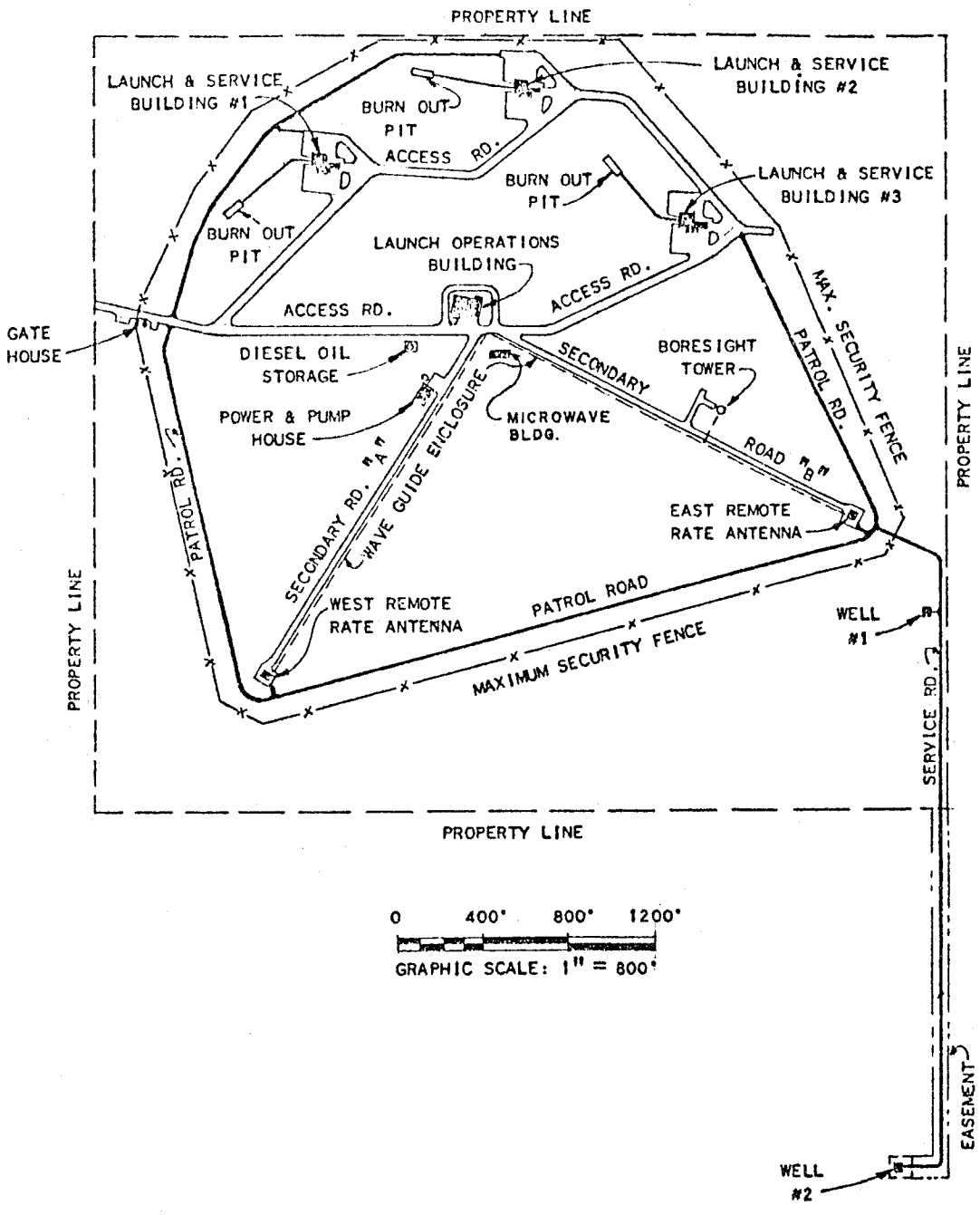
5. Roads, grading and drainage.

6. Fencing and gates.

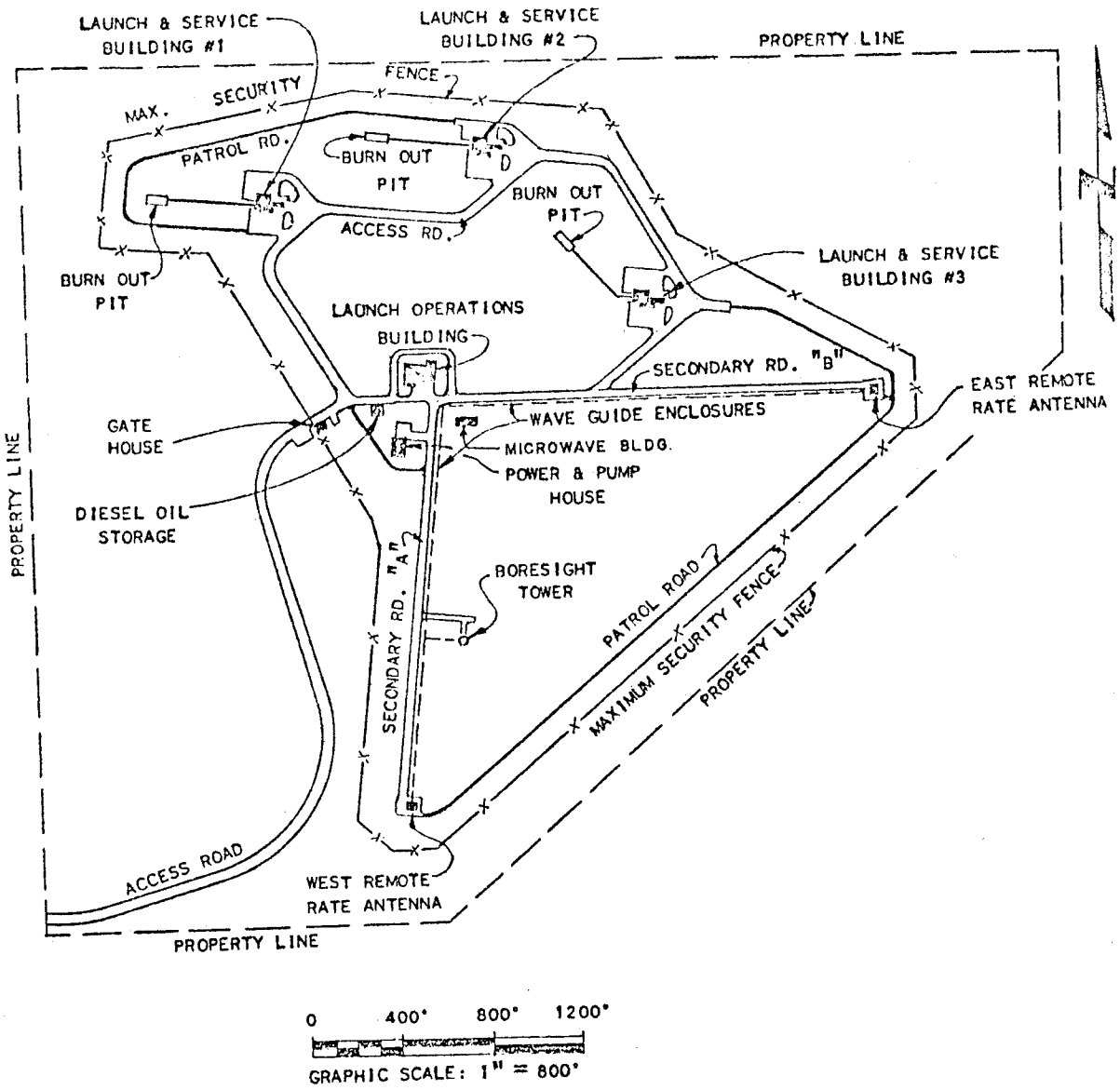
7. Burn-out pits and waste channels.



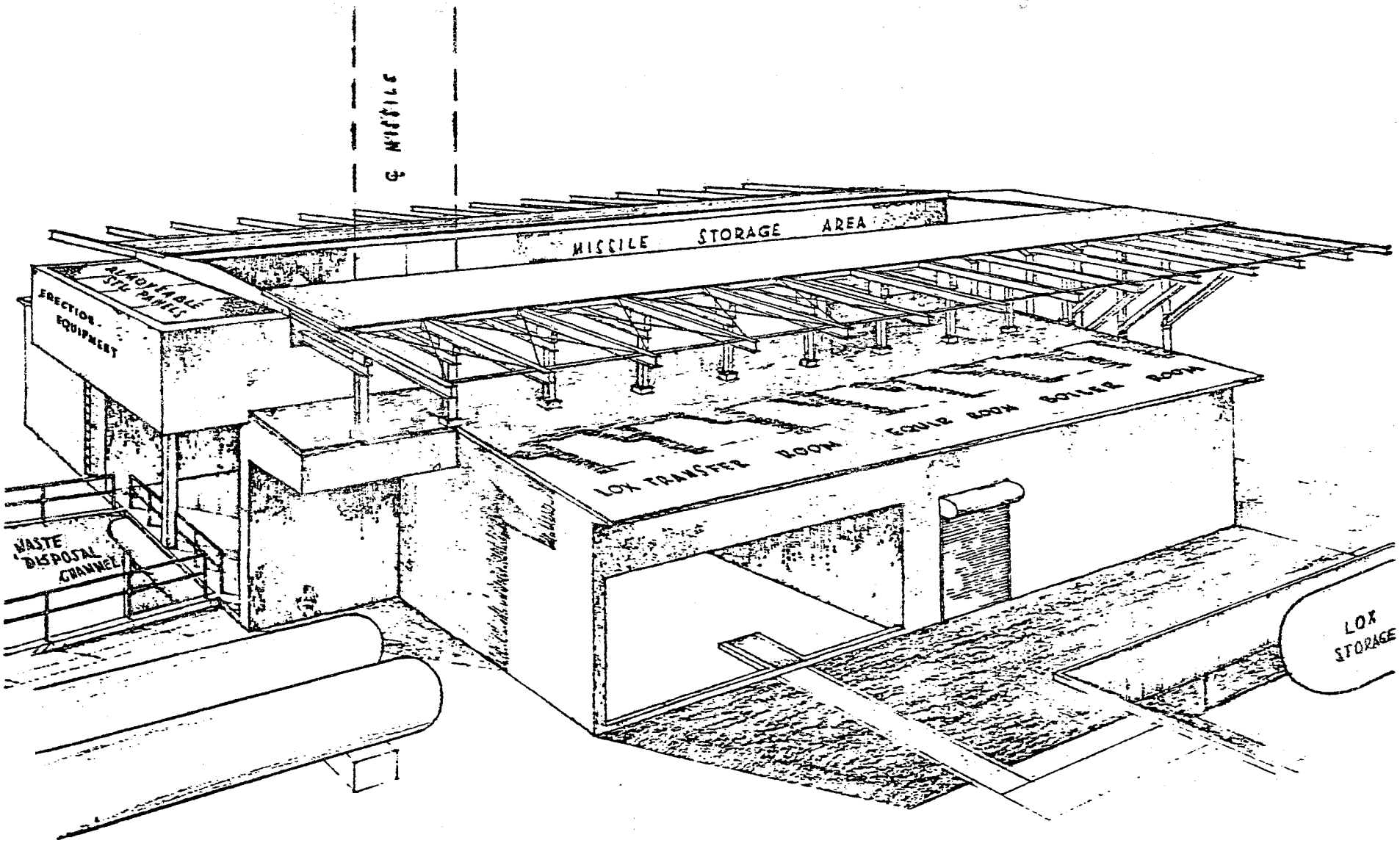
AIR FORCE BALLISTIC MISSILE DIV.
CHEYENNE MISSILE ANNEX B
SITE PLAN



AIR FORCE BALLISTIC MISSILE DIV.
CHEYENNE MISSILE ANNEX C
SITE PLAN



AIR FORCE BALLISTIC MISSILE DIV.
CHEYENNE MISSILE ANNEX D
SITE PLAN



LAUNCH & SERVICE BUILDING
PERSPECTIVE

TYPICAL FOR ANNEXES "B", "C", & "D"

LAUNCH & GUIDANCE FACILITIES (ANNEXES "B", "C", AND "D"):

Each Annex will include three Missile Launch & Service Buildings (each with one launcher), a Launch Operations Facility, and the necessary roads, utilities, water, sewage and electric power generation.

The Launch & Service Buildings are 101 x 134 feet with reinforced concrete walls and floor. The service rooms have reinforced concrete slab roofs and the missile bay has a mobile roof which may be moved to permit vertical positioning of the missile and firing. The missile may be serviced in the horizontal position under cover of the mobile roof.

The launching and inflight guidance of the missile is accomplished by the Launch Operations Facility. The principal feature of the Guidance System is the Launch Operations Building. This is a one story structure, 107 x 121 feet with partial basement. The walls, floors, and roofs are of reinforced concrete. The Guidance Facility also includes one boresight tower and two remote rate stations located about 2000 feet from the Launch Operations Building, to which they are connected by waveguide inclosures.

ATLAS MISSILE DATA:

The United States' first ballistic missile project, the SM-65 ATLAS, is currently entering the final phase of its development program. It is powered by a cluster of liquid propellant rocket engines, burning liquid oxygen and RP-1, a kerosene-like hydrocarbon fuel, and is designed to deliver a thermonuclear warhead 6,325 statute miles.

The propulsion unit consists of two large booster engines in the first stage, one sustainer engine and two small "vernier" rockets in the second stages. All five rockets are ignited prior to launching. After a few minutes of flight during which time the missile is propelled well into

Weight (Gross), lb: 243,000

Material (Major): Steel

GUIDANCE:

Manufacturer: GE/Burroughs

Type: Radar-Doppler Command

POWER PLANTS:

First Stage (Booster)

Manufacturer: Rocketdyne

Propellants: Liquid Oxygen and Kerosene

Type & Number: Regenerative Liquid (2)

Thrust, lb: 300,000

Sustainer: 60,000 lb.

WARHEAD:

Type: Nuclear

SURVEYS AND SOILS INVESTIGATIONS, F. E. WARREN AFB:

In letter from AFBMD dated 16 October 1957 with subsequent indorsements from MRD, the last of which was dated 31 October 1957, the surveying and mapping of F. E. Warren Aux Sites "A" and "B" were authorized. The initial surveys consisting of the topographic mapping of the two sites along with a land survey plus the survey of eleven miles of access road and the establishment of prime control with ties to the State coordinate system were completed by 20 December 1957.

On 23 December 1957 surveys of the restrictive easements on Sites "A" and "B" were begun. This work was completed on Site "A" by 18 Jan 1958; however, prior to the completion of the work on Site "B", the site was deleted from the program.

Based on advanced information from AFRCE-MKA to MRD, the photogrammetric mapping of Sites "C" and "D" was begun on 28 March 1958. Final mapping of Site "C" was completed on 19 May 1958, but in compliance with AFBMD's decision that Site "D" was unsatisfactory, mapping on this site was suspended on 7 May 1958. On 17 June 1958, MRD ordered the mapping of two new locations for Site "D", sites were to be designated as Area D-1 and Area D-2. The 1" = 400' scale mapping of these two areas was completed on 7 Aug 1958 and the Omaha District was then ordered to proceed with the final 1" = 50' scale mapping of Area D-1 only which mapping covered an area of 800 acres. This final mapping of the Area D-1 was completed on 23 September 1958.

WARREN SITE ACTIVATION TASK FORCE (ATLAS)

Atch 1

COMMANDER (TFC)
Col. E. A. Swanke — Ph: 72003

- ...OR RELATIONS (TFL) — 73933
- COMMUNICATIONS (TFE) — Capt. Carl S. Jennings — 73730
- SURVEILLANCE (TFS) — LtCol. H. E. Hartwell — 73511
- ADMINISTRATIVE SERVICES (TFA) — Maj. Vernol L. Smith — 77345
  - MESSAGE CENTER (TFAM) — MSgt S.R. Teunisson — 77528
  - SECURITY (TFAS) — 77524
- OPERATIONS AND PLANS (TFP) — Capt. Francis L. Wright — 73 736
  - PROGRAM CONTROL (TFPP) — 72529
  - COMMAND POST (TFPC) — 73736
- DEPUTY FOR CONTRACT ADMINISTRATION (TFM) — Maj. James E. Hessman — 77422
  - QUALITY CONTROL (TFMQ) — Mr. Story — 77320
  - PRODUCTION SURVEILLANCE (TFMP) — Mr. Cornell — 73936
  - INDUSTRIAL PROPERTY (TFMI) — Mr. Jackson — 73935
  - CONTRACT ADMINISTRATION (TFMC) — Mr. Taylor — 73934
- DEPUTY FOR WEAPON SYSTEMS E[illegible]ERING (TFR) — LtCol. Dan D. Oxley — 73730
  - CONSTRUCTION (TFRC) — LtCol. Edward Gastreich — 73431
  - GUIDANCE (TFRG) — Capt. Patrick J. Corrigan — 73730
  - APCHs & LAUNCH CONTROL (TFRL) — Capt. Wm. D. Knox — 73730
  - MISSILE & GSE (TFRM) — Capt. Virgil Fordham — 73730
- DEPUTY FOR LOGISTICS (TFB) — LtCol. McLaren — 77301
  - LOGISTICS (TFBL) — Mr. Neff — 77210
  - IN-SERVICE ENGINEERING (TFBE) — Maj. Beaumont — 73730
  - COMMUNICATIONS (TFBL) — 73730

APPROVED:
E. E. SWANKE
Colonel, USAF
Commander

20 Sep 60

WARREN 11

SECTION 2
DESIGN - PLANNING
F.E. WARREN II

The F. E. Warren AFB, Atlas ICBM Squadron II is a 3-complex (or sites) layout of three launchers each in the general vicinity of F. E. Warren AFB.

Structures are above ground, and are of steel and concrete construction. Each complex is complete in itself, with all necessary power, guidance, and control facilities and supporting utilities. The Propellant Loading System Skid assemblies for this contract were provided the prime contractor by the Winger Construction Company under separate contract with the Government.

Contract for F. E. Warren AFB, Squadron II was awarded the Blount Brothers Construction Company 11 March 1959, and work started 30 March 1959. Progress was not entirely satisfactory due to poor organization by the contractor, numerous modifications, inclement weather, and unforeseen difficulties encountered in testing the Propellant Loading System. These delays are covered in detail elsewhere in this brochure.

DESIGN

The plans and specifications were definite and "biddable" as to the construction requirements at the time the bids were taken. This is supported by the examination of the bids received and the Government estimate. At the time bids were taken, the plans and specifications, thought containing more errors than found in such documents prepared under normal procedures, were sufficiently complete and definite to permit preparation of firm bids.

SHOP DRAWINGS:

Since the design of the Atlas squadrons was developed hurriedly and more or less on a trial and error basis, some of the design had to be completed on the basis of shop drawings. An extremely large number of shop drawing submittals was required to complete each squadron. The large volume of correspondence connected therewith was a delaying factor. It was noted that the unfamiliarity of AFBMD with the true meaning of a shop drawing led to confusion and some indecisions. A minor delaying factor was the failure of the contractor to follow closely the status of his shop drawings and to expedite the submittal of corrected drawings.

ARCHITECT ENGINEER CAPABILITIES:

The AE proved capable in each case. However, a delaying factor was the comunication set up. Normally it was necessary for the AE to operate thru AFBMD rather than going direct to the Area Engineer. The flow of communication in the other direction was also slow due to the operations of AFBMD.

REPORTING AND ADMINISTRATIV E EFFORT:

The principle delaying factor was the requirement that on practically every controversial item 3 or 4 letters had to be dispatched to keep all parties informed. Normally the action letters would go to the contractor, one letter to AFBMD, one to the AE and finally an information letter to the District Office.

LAUNCH FACILITY AND UTILITIES:

1. Original planning contemplated a six launcher complex, same as Squadron I, at each of Sites B, C and D. Site B was located on siting trip of 22 to 25 October 1957, and surveys and foundation investigation forwarded in December 1957. Additional soils data required in January 1958 and structure locations were shifted.

2. Schedules furnished in missile conference in Los Angeles 7 February 1958 provided for award of Site B, and Site D after Site C but subject to change to go ahead of C.

3. Schedule furnished in missile conference in MRD on 23 March 1958 provided for award and start of construction of Site B 30 days after Squadron I or 31 July 1958.

4. Site C location was furnished for Real Estate action but was shifted to a new location on 30 January 1958.

5. Location of Site D (on base) and request for topography of Sites C and D was given in 24-25 March 1958 conference in Cheyenne. Preliminary soils investigations requested for Sites C and D on 1 April with general siting for C furnished 9 April 1958.

6. Work on Site D was held in abeyance 5 May 1958 prior to start of soils investigation. Work on Site C held in abeyance after receipt of information on simplified 3 x 3 complex on 7 May.

7. Site B relocated off base southwest of Cheyenne on 17 June with consideration being given to two sites. Preliminary soils investigation and topography proceeded on both sites as well as Site C.

8. New concept criteria for Squadron II (3 launchers on each of three sites, B, C and D) furnished in conference 29 July 1958.

9. Design completion scheduled for 15 January 1959. Construction completion in increments from 1 December 1959 to 15 March 1960.

10. Primary Site D selected and staked for drilling on 11 August 1958.

11. Foundation reports scheduled to be forwarded to AFBMD on 29 August delayed by lack of criteria from AFBMD that was not received until 2 September 1959. Reports forwarded 12 September.

12. For sake of standardization, PLS Skids and generators were advance procured for Omaha Squadron I and Warren II. Air conditioning equipment was to have been standardized per AFBMD instructions. Design proceeded on this basis and resulted in such an oversized system for Squadron II that the system was redesigned after project review period to fit Warren conditions.

13. PLS Skids were scheduled to advertise 22 December 1958 with bid opening 22 January 1959. Final design received 7 January 1959, advertised 9 January and bids opening 12 February. Bid opening was delayed one week to allow bidding of optional valves for 13 previously specified proprietary Minneapolis-Honeywell valves. Some of the optional valves furnished later proved incompatible in the system operation and required replacement. Numerous other valves and regulators also had to be replaced for same reaons.

14. Final project submittal of B, C and D for review was scheduled 31 December 1958 but not received until 10 January 1959. Review conference was held 13 January not allowing sufficient time for review.

15. Final design for project was received on 19 January 1959, advertised 28 January 1959 and opened 4 March 1959. Construction release required completion in increments from 1 December 1959 to 15 February 1960. By subsequent revision to completion dates, joint occupancy was required on Site B by 28 October 1959.

16. Gate Houses deleted by Mod No. 6 created interface problems.

17. Mod No. 8 with over 200 changes injected by AFBMD Associate Contractors review and by AFBMD Architect-Engineer coordination check retarded ordering of materials and equipment and nullified numerous shop drawing approvals.

18. Mod No. 17 adding wave guide enclosures disrupted exterior work. The enclosures were later deleted from the project after determination made by Air Force that requirement no longer existed.

19. The problem of furnishing nitrogen recharging units for Squadron I recurred on Squadron II. Air Force was unable to furnish units and OD had to procure the units.

20. Control system testing and calibration was to have been function of AFBMD Associate Contractors. This work was made responsibility of OD and added to the PLS Skid contract.

Launch Facilities
Squadron II
F. E. Warren AFB

	Schedule	Actual
Design from AFBMD	Jan 59	19 Jan 59
Contract award	1 Mar 59	11 Mar 59

Bid invitation advertised on 28 January 1959 and opened on 4 March 1959.

Following addenda were issued under bid invitation:

Addendum No. 1 issued 13 February 1959 consisting of:

Specifications revisions - 20
Descriptive drawing revisions - 19
New drawings added - 36

Addendum No. 2 issued 21 February 1959 consisting of:

Specification revisions - 449
Descriptive drawing revisions - 193
Drawings reissued - 13

Addendum No. 3 issued 24 February 1959 consisting of:

Specification revisions - 27
Descriptive drawing revisions - 37

Addendum No. 4 issued 25 February 1959 consisting of:

Specification revisions - 5

Addendum No. 5 (Telegraphic) issued 27 February 1959 consisting of:

Descriptive drawings revisions - 4

Addendum No. 6 (Telegraphic) issued 28 February 1959 consisting of:

Specification revision - 1

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Squadron II
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SECTION 3
CONSTRUCTION PERIOD - SIGNIFICANT PROBLEMS
F. E. WARREN SQUADRON II
DA-5498

1. Furnishing suitable vacuum system for Dewars.

a. Description. Steel and Alloy Company of New Jersey was delayed in delivering the Dewars due to the fact that they could not obtain and hold a vacuum on the Dewars which they had fabricated. This was attributed to:

(1) Swagelok fittings which the contractor contended were not suitable for this system.

(2) Screwed fittings on main line leaked.

(3) Powell Valves were unsatisfactory.

(4) Rupture discs were unsatisfactory.

The shipment of vessels was delayed to the extent that the contract was delayed from 3 to 4 months.

b. Action taken:

(1) On 13 November 1959, contractor was given permission to substitute sweated fittings for swagelok fittings.

(2) On 22 December 1959 the contractor was granted the option of flanged and/or welded connections in lieu of screwed connections on the main line.

(3) On 4 December 1959 contractor was granted permission to substitute standard spring loaded relief valves for Powell Valves.

(4) The contractor was granted permission on 4 December 1959 to substitute flanged spring loaded relief valves for rupture discs. However, system was installed at site with modified disc-type rupture.

2. Contaminated RP-1 Tanks (Excusable Delay).

a. Description. The contractor could not obtain clean RP-1 tanks due to the difficulty in reaching interior of the header which caused 30 to 60 day delay.

b. Action taken. Contractor was given permission to cut end of header and replace with a blind flange therefore permitting ready access to interior for cleaning.

3. Replacement of Velan Valves (Mod 98).

a. Description. Approximately 15 to 45 days were lost during field testing due to replacement of Velan valves. Replacement was necessary because valves did not meet operational requirements when tested by the Air Force Independent Laboratory.

b. Action Taken. Vacco valves were tested, met the operational requirements and were approved as a substitute for Velan valves. This substitution incurred a delay because of the interruption to the testing procedure and necessary time to change the valves.

4. Dirty Line and Government-furnished Skid (Excusable Delay)

a. Description. Contaminated line of Government-furnished skids incurred approximately 10-day delay to contractors.

b. Action Taken: Lines recleaned by Winger Construction Co., skid supplier, working on an accelerated schedule.

5. Breakdown of Pumping DRI Units (Excusable Delay)

a. Description. Breakdown of DRI units incurred delay of approximately 15 days. On 19 May 1960, two DRI units were shipped to Omaha for use at that site and were not returned to Cheyenne until 8 July 1960. Approximately 15 days were lost during this period for a total of approximately 30 days.

b. Action Taken: (PLS testing carried out on an accelerated schedule to complete work on earliest date possible).

6. Lack of Transfer Hose. (Excusable Delay)

a. Description. A delay of approximately 5 days was incurred because of the lack of enough transfer hose with proper ordnance fittings.

b. Action Taken: Government expedited and obtained additional suitable hose.

7. Recleaning of pressure vessels and cryogenic vessels (Not excusable).

a. Description: A delay of approximately 30 days was incurred due to the fact that certain vessels were determined to be contaminated after receipt at the job site and required recleaning.

b. Action Taken: Recleaning operations carried out on an accelerated schedule.

8. Poor supervision of electrical subcontractor and slow down of work by electricians. (Not excusable)

a. Description. Electrical subcontractor did not have adequate supervision to plan and carry out work actively and efficiently. The electrical labor forces apparently deliberately slowed down work to prolong their employment. No estimate of time has been made.

b. Action Taken. These delaying factors discussed with prime contractor and subcontractor at meetings at the Area Office. Supervision was improved and added shifts, increased personnel and overtime used to accelerate the work.

9. Inexperienced supervision and inexperienced PLS testing personnel for mechanical subcontract work. (Not excusable)

a. Description: Considerable time was lost due to lack of qualified technical supervision to get the testing program rolling.

b. Action taken: This problem discussed at Area Office and contractor urged to correct situation. This was improved when the mechanical subcontractor employed Electro-Mechanical System Corp. to provide technical experience.

10. Items such as anchor bolts, concrete, etc, improperly placed by contractor required removal and replacement. (Not excusable)

a. Description. Anchor bolts placed in wrong location, form failures, placing concrete to improper lines and grades and other improper installations delayed the work.

b. Action Taken: Contractor urged to do replacement work on overtime basis to regain lost time.

11. Shortage of form materials. (Not excusable)

a. Description. The contractor lacked sufficient quantity of form material particularly in early phase of construction at Sites B and C which curtailed concrete work.

b. Action Taken: Area Office personnel continually pressured the prime contractor to obtain additional materials. Contractor did go to overtime operation and hired additional carpenters to regain schedule progress.

12. Control System Testing by Winger Construction Company.

a. Description. Control system testing had not been included in Contract DA-5498, Squadron II. (Blount Contract). It was added to the contract for Government-furnished skids (DA-5464), Winger Construction Co. This testing could not be completed until the PLS testing was completed by Blount.

b. Action Taken: All work was accomplished on an accelerated schedule.

A. D. LITTLE, INC., DESIGNERS OF MISSILE LOADING SYSTEMS

(SOURCE UNKNOWN)

Arthur D. Little, Inc., an international industrial research company with headquarters in Cambridge, Mass., is putting its special knowledge of cryogenics to work for the security and space exploration programs of the United States Government.

Working directly with the Air Force on Atlas and Titan intercontinental ballistic missiles, engineers and scientists at Arthur D. Little, Inc. prepared designs and specifications for propellant loading systems. Similar work on the Thor intermediate range ballistic missile was performed under contract.

The Atlas, Titan, and Thor missiles use a Kerosene-type fuel and liquid oxygen (LOX). At atmosphere pressure, the boiling point of oxygen is approximately -297 degrees. When exposed to normal temperatures, the liquid oxygen rapidly boils in the same way water would boil if it were heated several hundred degrees above its boiling point. In changing from a liquid to a gas, oxygen also expands in volume 800 times.

The storage of liquid oxygen and its controlled rapid transfer to the missiles presents problems in thermodynamics, fluid flow, stress analysis, chemistry, physics, and electronics.

In contact with liquid oxygen, ordinary steels become extremely brittle and standard lubricants become violently explosive. Over the wide range of temperatures existing during loading, valves must operate reliably, gaskets must provide effective seals, and expansion joints must accommodate dimensional changes.

This is where ADL's two decades of experience in cryogenics -or low temperature-research has contributed to the nation's security and space programs.

The ADL team of engineers and scientists developed the first fully automatic system for the high-rate transfer of low temperature fluid, piping thousands of gallons of LOX at -297 degrees F. Besides using electronic computers to analyze stresses in the piping and figuring effects of weather conditions on the rate of LOX evaporation, the ADL team helped develop valves and gaskets that would operate reliably, devised a method for accurately determining the quantity of LOX in a tank, and drew up proper handling procedures for the safety of the operation.

The senior ADL surveillance engineer at Warren Air Force Base is Benjamin H. Bakerjian, and Arthur F. Sullivan is in charge of start-up. Assisting in their work are M. Howard Benton, Roman C. Cloud, Christopher D. DeFraia, G. Lennart Gustafson, Lawrence S. Peak, and Jacqueline B. Sanders.

Arthur D. Little, Inc. has grown from a two-man analytical laboratory founded in 1886 into a 1200-man research team today. It has five offices in the United States and three permanent operations overseas.

To handle research projects sponsored by industries and governments around the world, ADL organizes its specialists in mathematics, physics, chemistry, electronics, and various phases of engineering into problems solving groups.

With this intra-company cooperation, Arthur D. Little men have undertaken problems in the development of food, paper, chemical, and

mechanical products; petroleum and mineral re-fining processes; procedure and systems analysis; and city, regional, and national economic studies for government organizations both in this country and abroad.

END OF ARTICLE

SECTION 4

HISTORY OF PRIME CONSTRUCTION-NEWSPAPER ARTICLES

F. E. WARREN AFB

AUGUST 6, 1958 - THIRD ATLAS LAUNCH SITE BARED - BIDS INVITED FOR ROAD PROJECT IN CAMPSTOOL AREA. A third site - designated as "C" and located about 15 miles southeast of Cheyenne, in the Warren air base Atlas ICBM complex - was disclosed today by the Army Engineers in inviting bids for construction of an access road from U. S. 30.

Site C will be developed on more than a section of land approximately four miles south of U. S. 30 and two miles east and about a mile south of Campstool. This is south of both the Burlington railroad line to Sterling and Crow creek.

The location is just off (by about a mile and one-half) the Wyoming Hereford ranch. Owners of the involved land were not named.

The bid invitation is effective August 7, tomorrow, and they will be opened on or about September 4, the engineers said.

The announcement stilled rumors that the Warren Atlas project might not include more than Sites A and B, both of which are in varying construction phases. The original announcement of the Atlas base, for Cheyenne, revealed a plan for four missile-launching facilities on four sides of Wyoming's capital city.

Location of the fourth site, to be designated "D", will doubtless be revealed within the next few weeks. It is expected to be located to the southwest of Cheyenne, and also at a distance of between 15 and 20 miles.

The Site C access road project will include four well pumping stations (test wells have indicated water facilities sufficient to be

serviced by 100-gallon-a-minute pumps), and a bridge over Crow Creek.

The work will involve: 24,000 lineal feet of road (about four miles); 85,000 square yards of bituminous paving; 145,000 square yards of base course surfacing; 93,000 lineal feet of barbed wire fencing, and 66 lineal feet of concrete and steel for the bridge.

Projects under way on Sites A and B of the Atlas base include:

Site A - Access road, by Beckham Construction company of Sioux Falls, S. D.

Guidance facilities, by Doolittle Construction company of Wichita, Kansas.

Launch facilities and utilities, by the George A. Fuller company of Los Angeles. (The latter involves a contract in excess of $11,000,000).

Site B - Access road, by Peter Kiewit and Sons Construction company of Sheridan.

Announcements concerning guidance facilities, and launch and utility facilities, for Site B are expected soon. Similar installations are also to follow in due time for Site C, and ultimately for Site D.

DECEMBER 17, 1958 - PACIFIST WILL BE RELEASED FROM COUNTY JAIL - REV. OLSEN PLANS TO LEAVE DEC. 23 - The last of a group of pacifists who tried unsuccessfully through much of the summer to block construction of a missile-launching site north of Cheyenne plans to leave here Dec. 23.

He is the Rev. Theodore Olsen, Fallsington, Pa., who was committed to Laramie county jail Aug. 19, upon his failure to pay a

fine levied against him by Justice of the Peace Tosh Suyematsu on charges of trespass.

Olsen was actually sentenced to jail for two days on a charge of contempt of court. Suyematsu asked him if he were released if he would return to his passive resistance activities at the missile base and Olsen replied, "Yes."

Several others of the pacifist group went to jail in lieu of payment of trespass fines, but all paid their fines and left Cheyenne long ago. Olsen, who could have elected to request payment of his fine by the pacifist group sponsoring the resistance "project" here, said he felt it was his "moral duty" to serve out the fine.

Activities of the pacifist group began here in June with Olsen and Arthur Springer of Brooklyn, N. Y. For a time, they carried on what they called a "public information project" alone.

By mid-summer they were reinforced by others of pacifist convictions and there were silent prayer demonstrations, and finally a physical effort to block movement of vehicles in and out of the construction site. Kenneth Calkins, a young Phi Beta Kappa student from Chicago U. was run over by a truck after he sat in front of it at a cattle gate at the site entrance.

Arrest of Olsen, Springer, Calkins, his wife and others followed this incident.

There were other demonstrations of protest, consisting largely of groups of persons standing silently near the entrance to the construction site.

Following arrest of the group's members for trepass and sen-

tencing of all of them to jail, there were no more efforts to block construction of the missile site except by moral persuasion.

About two weeks ago, Cheyenneites were reminded of the days late in the summer when this city was the focus of national attention due to activities of the pacifists here.

Another pacifist group invaded the site of a missile base under construction in England. Their tactics were largely in contrast to those employed here, since they poured enmasse into the site and tried to stop work. The only similarity was that one man did sit in front of a truck in an attempt to keep it from moving. He was bodily ejected from the area.

Olsen told the Tribune he planned to go to his home at Fallsington to spend Christmas. He said he didn't know what further part he might take in any pacifist programs.

JANUARY 7, 1959 - TOP OFFICERS VISIT ATLAS BASE LAYOUT - Major Gen. Walter K. Wilson Jr., deputy chief of engineers for construction for the Corps of Engineers at Washington, and Major Gen. Keith R. Barney, Missouri river division engineer and Col. David G. Hammond, district engineer, at Omaha, arrived at Cheyenne today for an inspection of construction activities by the corps in the Cheyenne area.

General Wilson and his party met with officials of Warren Air Base at a luncheon at the Officers club. During the afternoon the party inspected Atlas base construction activities. The corps is constructing facilities on the site for an operational unit of the 706th Strategic Missile Wing (ICBM) Atlas.

Upon completion of the inspection General Wilson left by plane

for Kansas City for an inspection of the activities of the Kansas City district of the corps. General Barney and Colonel Hammond departed by train for Omaha.

CHEYENNE EAGLE - JANUARY 20, 1959 - BIDS ON THREE ATLAS SITES TO BE OPENED - Bids will be opened on or about February 26 for the construction of three more Atlas missile launching sites for the Warren Air Force base complex, the Corps of Engineers, Omaha district, announced yesterday.

Each of the three launching sites, to be located northeast, southeast and southwest of Cheyenne is estimated to cost between $5,000,000 and $7,000,000, for a total project of between $15,000,000 and $21,000,000.

Each of the three additional sites will be smaller than the first site which has been under construction since last fall and which is located northwest of Cheyenne.

The Corps of Engineers announcement stated: "On or about Jan. 27, this office will issue invitation for bids on the construction of launch facilities and utilities, Squadron II, Warren AFB. Bids will be opened on or about Feb. 26."

The successful contractor will be required to commence work within 10 days after notice of acceptance of bids and complete the work in approximately 360 days.

The work will include nine launch and service buildings, 134X101, reinforced concrete with mobile roof, propellant and gaseous storage vessels and process piping.

Three launch operations buildings, 121X96, two story, reinforced concrete construction with heating and air conditioning.

Three power and pump houses, 72X46, steel frame construction with disel fuel oil storage tank and water storage tank; four well pumps and pump houses utilities including water lines, sewage disposal systems, underground electrical ducts, etc., installation of nine generators.

The latest call for bids will complete the originally announced Warren AFB missile complex of four launching sites at a cost of about $60,000,000.

Still under consideration, according to defense officials, is the construction of two or possibly three more launching sites somewhat further removed from Warren but still to be serviced by Warren facilities.

Construction of the first missile launching site was started last summer with the George A. Fuller Co., as prime contractor. Completion of the first site is scheduled by the end of this year.

WYOMING STATE TRIBUNE - MARCH 31, 1959 - IT WILL BE CHEYENNE'S BIGGEST - Cheyenne is indeed on the threshold of the greatest building year in its history.

The prospect - an assured one - is indeed imposing, headlined by the construction of the four Atlas missile launching pad complexes to ring the city.

Building of one of these (Site A) northwest of the city, has been under way since last summer. Before the onset of inclement weather last fall (November), it was providing jobs for nearly 900 men in widely-varied phases of the project.

As the weather improves (surely it will), stepup will return to Site A and, under a different contractor, a big building force will begin developing on Sites B, C and D (northeast, east and west of Cheyenne, respectively).

MAY18, 1959 - GEN. WHITE, DOUGLAS VIEW MISSILE SITES - Air Force Secretary James H. Douglas and Chief of Staff Gen. Thomas D. White inspected missile facilities at Warren Air Force base Saturday afternoon after flying here from Colorado Springs.

The two ranking officials of the Air Force were driven on a tour of missile launching facilities now under construction near Cheyenne. Newsmen were told a helicopter at the municipal airport had been flown here from Denver to take the two on the trip, but they elected to go by car instead.

They received the usual red carpet treatment upon alighting from their plane. They were met by a group of civilian and military officials as well as 68-year-old Master Sergeant Fred Christman.

Gen. White and Christman had both served together in Panama when the general was a 21-year-old second lieutenant in the infantry. Christman was somewhat disappointed to learn the general would be here only a few hours and had no time to take a fishing jaunt he had hoped for. Christman is a veteran of 55 years service in the Army and Air Force.

Douglas and Gen. White left Cheyenne Saturday.

WYOMING STATE TRIBUNE AND WYOMING EAGLE - JULY 21-24, 1959 - BLOUNT, MAIN ATLAS MISSILE SITE CONTRACTOR, TOP CONSTRUCTION FIRM -

Blount Brothers Construction Company of Montgomery, Ala., prime

contractor for the Warren Air Force Base Atlas missile sites B, C, and D, and the microwave and nose cone facilities, project that total $13,246,400, is the 48th largest heavy construction company in the United States among 100 leading firms.

Backed by three generations of experience, the firm's operations are nationwide and involve almost every type of building and construction including both large and small jobs.

The company is headed by affable, energetic Winton M. Blount who is the president. His brother, William H. Blount, is the vice-president of the firm and also is in charge of the operation of subsidiary companies engaged in the production of construction materials.

The Blount tradition started with their railroad-building grandfather in 1899. The work was taken over by their father and uncle in 1919 with the management of the company passing to the present Blount brothers in 1946.

The Blounts early realized an important fact that the real foundation of their construction business is the human element, men. So to complement their great inventory of construction machinery and equipment, they have built up an organization composed of some of the nation's most progressive and widely experienced men in the construction industry. In the past decade the firm has become one of the fastest growing construction companies in the country.

Blount Construction Company is divided into two divisions, these include the building division which is now in Cheyenne, and the construction division which is located at Montgomery, Ala. The building division in Cheyenne, located at 1509 Bent, includes a payroll

office, purchasing office, expediting office, engineering office, receptionist office and offices for the head engineers.

Work in which the company is now engaged in Cheyenne consists of the construction of nine launching pads for the Atlas intercontinental ballistics missile including the associated facilities of service buildings, since each launching unit is independent of the others.

The nine launching pads which are under construction by Blount are nine of the 12 already built. A total of 21 launching pads is being contemplated by the Army Corps of Engineers agents for the Ballistic Missile Division, all within a 50-mile radius of Cheyenne and located north, east, south and west of the city.

As general contractor, Blount's work includes all the coordination of work necessary to make the sites operational.

At present there are 60 sub-contractor firms also employed in the project.

There are 400 men employed by Blount with as many local workers as possible being used in the actual construction work.

When Blount received the award on the general contract from the Corps of Engineers, the firm moved key supervisory personnel to Cheyenne in March and began work on March 23 of this year. The contract work is to be completed by Feb. 1, 1960 and the firm is on schedule at the present time.

The Corps of Engineers is supervising the job and Blount Personnel work in close cooperation with the Corps.

Microwave facilities and nose cone facilities contracts awarded

to Blount for work at Warren base proper include buildings and utilities for the microwave facilities for the four missile sites of A, B, C, and D, and the nose cone building and facilities which also involves construction at the four missile sites as well as at Warren base proper. The microwave project will cost $314,400 and the nose cone project $562,600, both of which are in addition to the $12,-419,400 launch pad facilities at the three launching sites.

The launching facilities also include such structures as those needed for helium and liquid oxygen tanks and piping.

Blount Construction Company has $70,000,000 in contracts now divided between the building division in Cheyenne and the heavy construction division at the home office in Montgomery.

In its operations, the firm is no stranger to working on various missile sites and other military installations.

SEPTEMBER 30, 1959 - GE SUPPLIES GUIDANCE SYSTEM FOR ATLAS ICBM - The Defense Systems Department of the General Electric Co. is principally a supplier of military weapon and support systems which require integration of diverse fields of knowledge. The function at Warren Air Force Base is to provide a complete system for electronically monitoring and guiding the Atlas missile.

In preparation for the arrival of the missile a large quantity of complex electronic equipment has been installed at Warren Air Force Base Auxiliary Site "A". When the missile becomes available, additional equipment will be installed in it.

Functionally, the ground guidance equipment transmits a series of interrogating signals to the flying missile. These signals are

received and answered by the airborne equipment and the answers are analyzed by a computer back on the ground. If the missile is not exactly on the programmed course, corrective commands are transmitted to it and the course is adjusted appropriately. The series of interrogations and responses is a continuous process, but each exchange takes only a small fraction of a second.

The accuracy of the General Electric Guidance System is reported in a recent issue of Aviation Week. The first operational Atlas ICBM fired from Vandenberg AFB, California, landed well within the small target area located 4,500 miles from the launch point.

Here at Warren, Mr. Jack Krinsky is the Defense Systems Department Base Manager; H. S. Broughall is the manager for administration for the same department.

SEPTEMBER 30, 1959 - FIRST ATLAS MISSILE IS ENROUTE FOR CHEYENNE

An Atlas intercontinental ballistics missile was en route on what may be the slowest trip of its career today -- a six-day haul by truck to Warren Air Force Base near Cheyenne, Wyoming.

The Air Force ballistics missile division here said the missile was expected to arrive at Site A of the Warren Atlas complex Friday or Saturday.

Air Force officials said Warren will be the nation's first ICBM base planned to be operational for war.

Altogether, six Atlases will be brought to Site A for installation. Warren's Atlas complex will be "loaded" with 24 missiles altogether when it is completed.

The announcement came as regional civil leaders, firemen and

policemen gathered at Warren for a briefing by the Air Force on intercontinental ballistics missiles.

Officials from Wyoming and Colorado attended.

Site A is nearly complete northeast of Cheyenne, and the last of its six launching pads is due for Air Force acceptance this week. Progress was delayed several days by a labor wrangle last month among a subcontractor, the Cheyenne local of the Plumbers & Steamfitters Union, and the local's international union.

Sites B, C and D, which will control three missiles each, are planned for completion in February. Bids for nine more launchers will be opened in November.

The Atlas en route from California is designed to be guided from a concrete "blockhouse" on the ground. This arrangement will be used for all 15 missiles included in the first three sites.

The last nine missiles, however, will be self-guiding utilizing "all-inertial guidance systems."

Because of this, the later launch sites can be widely dispersed -- some of them as far as 60 miles from Cheyenne. And they can be "semi-hardened" -- meaning they will be partially sunk in the ground and armored with concrete to withstand enemy attack.

When Warren's full Atlas complex is in operation, it will be manned by three full missile squadrons made up of about 5,000 men.

The whole complex will cost between $60 and $80 million to construct.

SECTION 5
CONTRACTS
ATLAS "D", F. E. WARREN - SQUADRON II

1. BASIC CONTRACTS

a. Squadron II, F.E. Warren Missile Base, was constructed from fund allocated under FY Programs 57, 58 and 59, and consisted of 13 construction contracts, 1 supply contract and 3 assigned supply contracts. Since these contracts were awarded over the period from 9 February 1959 through 26 April 1961, the amount of the original program does not reflect the dollar value at any given date but is the composite value of all contracts, Government costs, and contingencies at their respective award dates. The main launcher contract was awarded 11 March 1959 for $12,419,000.

b. Supply contracts for the Diesel Engine Generator sets were awarded on 9 February 1959. These three contracts were later assigned to the main launcher contractor and the contract amounts were included in the prime contractor's bid for the construction of the launcher complexes.

c. The Support and Procurement contracts were awarded from 20 February 1959 through 26 April 1961 for the amount of $3,117,000.

d. The sum of these 14 contracts amounted to $15,536,000. The estimated Government cost of $1,271,000 plus a contingency allowance of $2,923,000 brought the original project estimate to $19,730,000 of which $7,000 was collateral kitchen equipment funded from a different authorization. This amount will not be included in the summaries listed herein.

2. INCREASES

a. Additional costs incurred since award of these contracts fall generally into 11 categories:

(1) Design definitization.
(2) Criteria changes
(3) Interference corrections.
(4) Field changes.
(5) Modifications to Procurement and Support Contracts.
(6) Claims.
(7) Acceleration.
(8) Government costs.
(9) Other costs.
(10) Contingencies.
(11) Government-furnished equipment.

b. Approximately $424,000 was for definitized facility designs. These changes were as a result of stabilizing design after award of the contract and involved relocation of offices, revision of kitchen area, addition of tolerances to anchor bolts and beams in the missile erection area, increased weight of steel platforms, additional recesses for beam load points, rearrangement of equipment, increased horse-power rating, and substitution of solenoid valves for selector switches and pressure switches.

c. Criteria changes total $3,683,000 and include the following items: Installation of wave guide enclosures at all three sites, installation of control cable entrances, construction of wave guide annexes at each launch and operations building, lowering LOX area drain line, installation of a common grounding system, replacement of valves in the PLS piping, revision of PLS testing, and revisions to PLS filters.

d. Minor changes due to interference total $17,000.

e. The main launcher contract had many unit price items based on estimated contract quantities. These overruns amounted to approximately $43,000.

f. Modifications to the Procurement and Support contracts consisted mainly of revisions to the PLS skid contract. After award of the contract, it was necessary to modify the contract to provide for the testing and calibration of these skids by the manufacturer. In addition, revised criteria received subsequent to award of the contract required revisions in certain of the valves as well as the type packing used in the various lines. Modifications to the PLS skid contract totalled $2,725,000. The balance of $211,000 is for the modifications to the other support contracts.

g. Claims filed on this Squadron including acceleration amounted to $8,673,000. The major portion of the claims involved cleaning procedure of the FP-1 storage tanks and the high pressure vessels. One claim, with regard to the volume of the "Type R" gaseous vessels, was settled for $125,000. These claims were settled for $613,000 exclusive of acceleration.

h. Acceleration costs added approximately $5,218,000 to the cost of this program. These costs were incurred as a result of non-allowance of excusable time extensions in order that the facility could be turned over to the Using Service on the specified need date.

i. Government costs were increased by a total of $871,000 over the original estimate. These additional costs were as a result of an increase in both the scope and complexity of the testing services and maintaining additional inspection personnel at the site on an around-the-clock basis.

j. Other costs amounting to $30,000 were incurred as a result of minor relocation contracts and purchase orders for services and/or equipment.

k. Contingencies of $175 00 remain within the program.

l. Subsequent to the award of the Launcher contract, it was determined that the revised testing procedures required the use of additional nitrogen rechargers to effectively maintain schedule in testing the PLS. Therefore, contracts were entered into with various suppliers for the purchase of additional nitrogen rechargers. These contracts amounted to approximately $854,000.

m. In Summary:

(1) Original program, less contingency: $16,800,000

(2) Increases:

(a)	Design definitization	$ 424,000
(b)	Criteria changes	3,683,000
(c)	Interference corrections	17,000
(d)	Field Changes	43,000
(e)	Mods to Proc and Support Contracts	2,936,000
(f)	Claims	613,000
(g)	Acceleration	5,218,000
(h)	Government costs	871,000
(i)	Other costs	30,000
(j)	Contingencies	
(k)	Government-furn. Equip	854,000

(3) Subtotal 14,689,000

(4) Revised construction program $31,489,000

3. There are no potential claims or unawarded work pending in this Squadron.

4. Appended to this section is a complete listing of all modifications and a cost breakdown as of 30 April 1962 which shows the approximate final costs of Squadron II.

LIST OF SUBCONTRACTORS

Warren II - (Blount Brothers, Prime Contractor)

1. Yeik Construction Company (earthwork)
2. Josten Lumber (security fence)
3. Almond Electric Company (electrical)
4. M & B Drilling Company (drilling)
5. Wallace Process Piping (mechanical)
6. Square D Construction Company (steel erection)
7. C. V. Miller (water lines)
8. Hammond Iron Works (structural steel)
9. Sam Fox Sheet Metal Company (sheet metal)
10. Gunite Concrete and Construction Company (concrete)
11. A. S. Bell Construction Company (base course)
12. Sheet Metal Products (sheet metal)
13. Wyoming Paving (paving)
14. Andy Mynear Painting Company (painting)
15. A. H. Bennett Company (insulation)
16. Reidesel-Lowe Company (general construction)
17. Colorado Tile (tile)
18. Hughes-Josten Company (fencing)
19. ARMCO (laying pipe and culverts)
20. B. Davis Furniture Company (tile)
21. Minneapolis Honeywell Reg. Co. (valves)
22. Lauren Burt, Inc. (acoustical work)
23. Liskey Aluminum Company (insulating)
24. Carrier Corporation (air conditioning)
25. Chicago Pneumatic Tool Company (Diesel engine generators)
26. Temperature Engineering (air conditioning tests)
27. General Engineering Construction Company (seeding and mulching)
28. Electro-Mechanical Service (testing)
29. Barker ConstructionCompany (earthwork)
30. Walker Chemical Company (tank cleaning)
31. Berggen Construction Company (paving)
32. Cheyenne Sheet Metal (sheet metal)

SECTION 5
MODIFICATION SUMMARY
F. E. WARREN SQDNS I & II

DA-5464, PLS Skid Assemblies

MOD NO.	DESCRIPTION	SOURCE
1.	Revise valves, filters and piping	AF
2.	Provide one piece body type valves in lieu of split body type valves	AF
3.	Change size of liquid oxygen connections	AF
4.	Revise the instrument specifications	CE
5.	Provide watchman service	CE
6.	Revise specifications	AF
7.	Add dust plugs, revise surface passivator and provide additional testing of expansion joints	AF
8.	Change to S.S. Pipe (Sched 40) for Line 51	AF
9.	Provide removable inner liners for exp. joints	AF
10.	Cancelled	
11.	Install check valve and pop-safety valve	AF
12.	Change electrical wiring and equipment on valve L-2	CE
13.	Revise filter elements for L-16 and L-17 filters	CE
14.	Revise vent piping, adding filter connections and filter assemblies	AF
15.	Provide manuals, special drawings and spare parts list	AF
16.	Revise expansion joint hinge	AF
17.	Remove Teflon tape and oxylube lubrication	AF
18.	Time extension - delivery of skids	CE
19.	Acceleration costs in fabrication plant	CE
20.	Clean air lines	AF

MOD NO.	DESCRIPTION	SOURCE
21.	Reduce Retain Percentage from 10% to 5%	CE
22.	Control System Testing	AF
23.	Cadmium plate carbon steel parts of F-1 filter elements	AF
24.	Provide for procurement of valves for testing	AF
25.	Add paragraph to specs on accident prevention	CE
26.	Revise Elect work skid No. 5	AF
27.	Replace handwheels for Velan valves with larger handwheels	CE
28.	Time Extension	CE
29.	Revise Loading and block valve requirements	AF
30.	Clean all instrument air lines	AF
31.	Not Applicable (Offutt AFB only)	
32.	Not Applicable (Offutt AFB only)	
33.	Additional acceleration costs	AF
34.	Change fuel and supply lines	AF
35.	Cancelled	
36.	Delete needle valve and connect solenoid valve directly to volume tank	AF
37.	Change lines 141 to avoid conflict w/vent from valve S-71	CE
38.	Cancelled	
39.	Replace safety valves and crane valves	CE
40.	Provide for procurement of long lead materials for spare parts	CE
41.	Cancelled	
42.	Provide parker adapter in lieu of existing ferrule fittings	AF
43.	Mount regulators	CE

MOD NO.	DESCRIPTION	SOURCE
44.	Procure two additional helium compressors	CE
45.	Install positioners on control valves	AF
46.	Cost incurred for cleaning liquid sensors, LS-1-2	CE
47.	Not Applicable (Offutt AFB only)	
48.	Revise requirements for calibration of pressure gages and add requirement for calibration of vacuum gates	AF
49.	Provide rotating vent piping, Lines 72 and 73	AF
50.	Replace 108 Asco diaphragms	CE
51.	Not Applicable (Offutt AFB only)	
52.	Cancelled	
53.	Cancelled	
54.	Cancelled	
55.	Provide new elements for L-23 Filters	AF
56.	Provide stainless steel bolts and nuts and explosion proof flexible couplings	CE
57.	Not applicable (Offutt AFB only)	
58.	Replace teflon packing on Velan valves	CE
59.	Supply torgue wrench to set Velan valves	CE
60.	Additional shop burden caused by modifications and revisions to liquid level indicators	
	Total Cost (Incls U/runs of $4,500) $2,720,911.44	

DA-5498, Launch Facilities and Utilities

MOD NO.	DESCRIPTION	SOURCE
1.	Revision to project sign	AF
2.	Cancelled	
3.	Delete road change specs and control joint	CE
4.	Misc changes to air conditioning	AF
5.	Revise partial footing dimensions	AF
6.	Deletion of gate houses	CE
7.	Grounding barbed wire fence	AF
8.	Priority items - general additions and deletions	AF
9.	Additional items - general additions and deletions	AF
10.	Provide personnel gates and furnish sleeves	AF
11.	Revise power supply for new location of micro-wave bldgs Sites "B" & "C"	AF
12.	Relocate security fence and lights, Sites B, C and D	AF
13.	Revise P-6 waste connections; delete wire mesh around box girders	AF
14.	Rotate center ped. track antena (Site B) and rotate hanger plates	AF
15.	Change dimensions LOX stg pits, Sites B, C and D	AF
16.	Change specs to option of furnishing conc. rings	AF
17.	Modify wave guide between Launch Operations Bldg and Launcher Sites B, C & D	AF
18.	Provide one 3'-0"x1'-4" duct opening basement wall, LOB	AF
19.	Revise generator governor requirements, Sites B, C and D	CE
20.	Provide sleeves on bolts in critical areas; also correct design and drafting errors	AF
21.	Elec chgs, delete sleeves and punching of beams and relocate pod cooling coil	AF

MOD NO.	DESCRIPTION	SOURCE
22.	Rev flexible floor and provide misc elec changes	AF
23.	Change location of four conduits to the rate power distrib panel #5	AF
24.	Install gravel pockets below drain in electrical manholes	CE
25.	Cancelled	
26.	Rev conduit and the equipotential grounding system	AF
27.	Provide optical targets, install danger signs and redimension cable duct	AF
28.	Furnish materials for wave guide system	AF
29.	Revision to manhole No. 4, Site B	CE
30.	Provide supports pod cooling system duct, add cable trays and prov control and monitor circuity	AF
31.	Delete backfilling, relocate sec fences, provide 5 ply roofing and specification changes	AF
32.	Modify control air and GN2 backup control air flow diag and install air backup system	AF
33.	Reroute drain line fr the evaporative condenser, LOB	CE
34.	Change in fan and filter capacities	AF
35.	Revise manhole dimensions, Sites B and C	AF
36.	Revise liquid nitrogen supply connections	AF
37.	Constr of additional communication manholes	AF
38.	Addn of sec fence gate, Site D, and provide additional sewer piping	AF
39.	Revise magnetic motor starter	CE
40.	Add 3" gate valve and cast iron box near LOB reducer, Site D only	CE
41.	Install air ducts under flex floors in LOB, Sites B, C & D	AF
42.	Change completion schedule in specs to add top soiling, seeding and mulching	CE

MOD NO.	DESCRIPTION	SOURCE
43.	Add wall openings, locate communication equipment and weather proofing wall mounted phone	AF
44.	Change gradation on gunite	AF
45.	Revise tee and signal system, race way specifications	AF
46.	Provide enclosure for liquid oxygen tfr room	AF
47.	Delete stop-start push button switch and install normal duty safety switch	AF
48.	Provide pad for station service transformer, Sites B, C and D, Power Plant	AF
49.	Delete water supply and drains in plenum under flex floor and minor spec changes	AF
50.	Delete conflict of electrical ducts and LOX pit pipe trench	AF
51.	Delete shop assembly of mobile roof drive mechanism	CE
52.	Change ampere capacity of unit distribution substation from 1200 to 900	CE
53.	Remove concrete dips and replace dips with revised dimensions	CE
54.	Change circuit schedule on circuits P-88 and P-89	CE
55.	Rev to Section 5 of Tests Specs	AF
56.	Add neoprene gasket between flexible floor beams and flexible floor panels	AF
57.	Reserve areas in L&S Bldgs for location of GSE piping and cable trays	AF
58.	Change conductor on circuit P-125	AF
59.	Revise floor opening and rotate pedestal type outlet receptacles	AF
60.	Delete emergency light to track antenna station	AF
61.	Furnish non-saturator filler strips for LOX compatible joints	CE
62.	Relocation of the facility remote control and monitor panel, LOB	AF

MOD NO.	DESCRIPTION	SOURCE
63.	Provide cinch-joint terminal strips	AF
64.	Delete 20 amp receptacle and change conduit size	AF
65.	Delete third and fourth sentences, para 29-17d, specs	AF
66.	Cancelled	
67.	Cancelled	
68.	Revise location of thermostats	AF
69.	Determination of particle contamination	AF
70.	Modify pipe supports, B, C and D	AF
71.	Misc changes to sleeves, antennas, wall casing, valve guide encl, mobile roof and fascia	AF
72.	Finish temp electrical power, Site C, delete sheet copper ground studs, Sites B, C and D	AF
73.	Revise conduit installation to allow clearance between conduit and walls	AF
74.	Cancelled	
75.	Provide PA conduit and weather proof outlet boxes	AF
76.	Delete radio interference testing, Cont DA-5413	CE
77.	Delete firex stub-up, relocate AC duct and move liquid nitrogen panel	AF
78.	Move lower, middle and upper cable trays in tunnel and equip room areas	AF
79.	Delete missile service platform and provide threshold	AF
80.	Change insulation type for conductors in wet locations	CE
81.	Cancelled	
82.	Modify PLS testing procedures	CE
83.	Delete grouting and painting and relocate ladders	AF
84.	Cancelled	
85.	Cancelled	

MOD NO.	DESCRIPTION	SOURCE
86.	Cancelled	
87.	Misc changes to wiring, diagrams No. 6 and 7	AF
88.	Purchase and install 125 VDC Horn	CE
89.	Provide granular fill under LOX pit floor slab and exhaust channels	CE
90.	Time Extensions, LOB, Sites B, C and D	CE
91.	Cancelled	
92.	Reinforce foundations for the furnished diesel engines	CE
93.	Spec change in PLS testing system	CE
94.	Changes to PLS testing and standby requirements	AF
95.	Install No. 5 type vacuum relief valve vault	CE
96.	Correct dimensional discrepancy, wall opening, LOB	CE
97.	Cancelled	
98.	PLS testing	CE
99.	Modification and acceleration impact costs	CE
100.	Cancelled	
101.	Relocate steel ladder and platform, power and pump house	CE
102.	Replace all valves in Type I valve vault	CE
103.	Reclean RP-1 fuel storage tanks	CE
104.	Cancelled	
105.	Payment for procurement of strike bound steel	CE
106.	Payment for design deficiency and acceleration cryogenic vessels	CE
107.	Recleaning of Taylor Forge high pressure vessels	CE
108.	Revise specs for chiller motor, reduced voltage starters	CE
109.	Relocate engine gauge panels, Site "C"	CE
	Net Increase (Incls 0/runs of $42,661.84) . . $9,871,074.82	

DA-5553, Microwave Facil

MOD NO.	DESCRIPTION	SOURCE
1.	Resites Microwave Bldgs and Revises Elec Distrib System	AF
2.	Reinforce end walls, revise antenna, and correct drawing errors	AF
3.	Provide microwave facilities project sign	AF
4.	Revise and damp-proof manholes	CE
5.	Construct manhole 62A and seal and waterproof manhole 46B	CE
6.	Correct conduit entrance Site "C" and location of main switches at Sites "B" and "C"	CE
7.	Change in paving specifications	CE
8.	Change well pump motor size, hinge manhole covers and add heads over metal louvers	AF
9.	Extension of Completion Schedule (Para SC-1a(1)	CE
	Total Cost (Incls 0/runs of $1,436.01) $16,445.35	

DA-5604, Nose Cone Facil

1.	Provide for installation of fire hydrant	CE
2.	Provide for additional bldg and cubicle. Delete 2 bays base site and 1 bay Site B, C and D (Also applicable to Squadron I)	AF
3.	Applicable to Squadron I	AF
4.	Revise fire protection water supply - Bldg S-803	CE
5.	Applicable to Squadron I	
6.	Applicable to Squadron I	
7.	Applicable to Squadron I	
8.	Cancelled	
9.	Relocate parking lot for Tech Supply Bldg	AF
10.	Change service entrance conductors and conduit	AF

MOD NO.	DESCRIPTION	SOURCE
11.	Applicable to Squadron I	
12.	Remove canopies, painted window glass and weld smokestack	AF
13.	Applicable to Squadron I	
14.	Provide ductwork to toilet areas, Bldgs S-802 and S-803	CE
15.	Applicable to Squadron I	
16.	Addition of machine room - Bldg S-803	AF
17.	Unit Htr Elect Service - Bldg S-803	CE
18.	Permit for use of Bldg S-1112	CE
19.	Fasten Side Joints of Celludeck Roof Deck	CE
20.	Additional utility pole to provide clearance for high voltage crossing	CE
21.	Applicable to Squadron I	
22.	Furn and install 15 KV suspension type insulators	CE
23.	Delete storm sash for Bldg S-803	CE
24.	Cancelled	
25.	Acceleration to offset excusable delays	CE
	Net Increase (Incls O/runs of $2,916) $31,561.85	

DA-5618, Liquid Oxygen Facility

1.	Revise expansion joint material and project signs	CE
2.	Revise manhole elevation	CE
3.	Relocate ground wire and revise the 5 KV power supply	AF
4.	Provide surge tank and access, water proof LOX line insul revise gounding loc and rev elec hook-up for vacuum pump	AF
5.	Delete widening of intersection	CE
6.	Lower the floor in Liquid Oxygen Bldg	CE

MOD NO.	DESCRIPTION	SOURCE
7.	Delete 2" flexible hose	CE
8.	Delete switch and relocate pole line	CE
9.	Establish occupancy agreement for contractor to use a Government warehouse	CE
10.	Change pole and structures	CE
11.	Relocate thermostats	CE
12.	Add pressurization system to liquid oxygen storage tank	CE
13.	Change valve specs	CE
14	Cancelled	
15.	Provide additional pipe support anchor bolts	CE
	Total Cost (Incls 0/runs of $259.47) $74,617.60	

DA-5743, Alert Facilities Vehicle Storage

1.	Revise grade beam and column footings	CE
2.	Revise telephone and speaker location (See Sqdn I)	AF
	Net Increase $1,100	

DA-5836, Water Supply Fac, Site "D"

1.	Change gasoline tank	CE
2.	Remove unsuitable materials, backfilling and draining around pumphouse No. 1	CE
3.	Addition of pressure relief valve	CE
	Total Cost (Incls 0/runs of $8.55) $11,265.20	

DA-5954, Rehab Bldg 1200 Hdqtrs Wing

MOD NO.	DESCRIPTION	SOURCE
1.	Misc changes to conduit, windows and walls	CE
2.	Misc changes to bldg and heating system	CE
3.	Waive soil removal portion of washability test for latex base paint	CE
	Total Cost $5,317.65	

DA-6157, Veh Stg and Gate House

1.	Elect and telephone changes	AF
2.	Installation of additional telephone conduit and junction box	AF
3.	Cancelled	
4.	Extend tile field laterals	CE
5.	Provide and install corrugated steel wainscot	CE
6.	Time extension	CE
7.	Provide studding for wainscot	CE
8.	Paint exterior surfaces of doors	CE
	Total Cost $6,695.31	

DA-6380, Facil Chgs

1.	Fill in holes around fourth engine foundation and misc electrical changes (See Squadron I)	AF
2.	Relocate columns in L&S Bldgs, Sites B, C and D	CE
3.	Trim metal doors to fit openings	CE
4.	Applicable to Squadron I only	
	Total Cost $2,452.74	

DA-6381, Facil and Util Chgs

MOD NO.	DESCRIPTION	SOURCE
1.	Applicable to Squadron I only	
2.	Security alarm system, Sites A, B, C and D (also see Squadron I)	AF
3.	Relocate direct burial cable and relocate junction box	CE
4.	Applicable to Squadron I only	
5.	Applicable to Squadron I only	
6.	Multipath fence, Sites B, C and D	AF
7.	Time Extension	CE
8.	DC Power Source	CE
9.	Applicable to Squadron I only	
10.	Applicable to Squadron I only	
11.	Auth Repr of Contracting Officer (See Squadron I)	CE
	Total Cost $54,138	

DA-6467, Liquid Oxygen Facilities

1.	Applicable to Squadron III only	
2.	Applicable to Squadron I only	
3.	Revise position of three-way valves	AF
4.	Applicable to Squadron I only	
5.	Revise specifications for valve operations	AF
6.	Additional support transfer line	AF
7.	Add pressure gauges	AF
8.	Change size of lab cabinet	AF
9.	Standby costs (also on Squadron I)	AF
10.	Applicable to Squadron I only	
11.	Authorized Repr of Contracting Officer	CE
	Net Increase $9,234.58	

DA-6852, Warren I, II & III, Facility Charges

MOD NO.	DESCRIPTION	SOURCE
1.	Lengthen hoist rail	AF
2.	Applicable to Squadron I only	
3.	Applicable to Squadron I only	
4.	Applicable to Squadron III only	
5.	Applicable to Squadron I only	
6.	Applicable to Squadron I only	
7.	Auth Repr of Contracting Officer	
8.	Applicable to Squadron I only	
9.	Applicable to Squadron I only	
10.	Time Extension	CE
11.	Applicable to Squadron III only	
	Net Increase $2,432.10	

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JUSTIFICATION SUMMARY SHEET
($000,000)

MISSILE BASE F. E. WARREN MB - SQUADRON II AS OF 30 April 1962

Item	Original CCE	(1) CCE at Last Programming	(2) Current CCE	(2) - (1) Change
1. Basic Constr. Cost	$ 14.1	$ 16.4	$ 16.4	$ 0.0
2. Land	0.0	0.0	0.0	0.0
3. Utility Connections	0.0	0.0	0.0	0.0
4. Mods (Neg.)	0.0	7.1	7.1	0.0
5. Changes Issued	0.0	0.0	0.0	0.0
6. Claims Settled	0.0	5.8	5.8	0.0
7. Claims Validated (Unsettled)	0.0	0.0	0.0	0.0
8. Unawarded Work	0.0	0.0	0.0	0.0
9. Contingencies	2.9	0.0	0.0	0.0
10. Gov't. Cost	1.3	2.3	2.2	- 0.1
TOTAL CCE	18.3	31.6	31.5	- 0.1
Potential Claims	0.0	0.0	0.0	0.0

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1 Atch
Spread Sheet

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ESTIMATED ULTIMATE COST

F. E. WARREN MISSILE BASE
SQUADRON II

As of 30 April 1962

1. Funding vs Total P-321 Requirement

Total P-321 Requirement	$ 31,488,901.14
Funding	$ 31,505,901.14 *
Balance	$ 17,000.00

2. Allotments vs Obligations

Allotments Received	$ 31,572,643.00 (Form AF 378)*
Obligations Incurred	$ 31,485,578.29
Unobligated Allotments	$ 20,322.85 **
Commitments	$ 31,485,578.29
Uncommitted Balance	$ 20,322.85

3. Funding vs Ultimate

Estimate Ultimate Cost	$ 31,488,901.14
Funding	$ 31,505,901.14 *
Balance	$ 17,000.00

* BSLF-23-2-12 authorized use of station balance to cover deficit for Squad. I. Authorization reduced to $31,505,901.14.

** Based on revised authorization above.

FORECAST OF FUND REQUIREMENTS

BASE F. E. WARREN MB SQUAD II

REPORT AS OF 30 Apr 62

	COE	OBLIGATIONS	COMMITMENTS NOT OBLIGATED	[illegible]	FORECAST OF ADDITIONAL FUNDS REQUIRED
CONSTRUCTION COST	16,460,972.94	16,460,972.94			
MODS NEGOTIATED	7,053,153.71	7,053,153.71			
CHANGES ISSUED	5,831,888.00	5,831,888.00			
CLAIMS SETTLED					
CLAIMS PENDING					
UNAWARDED WORK					
CONTINGENCIES	175.47			175.47	
GOVERNMENT COST	2,142,711.02	2,139,563.64		3,147.38	
TOTAL	31,488,901.14	31,485,578.29		3,322.85 plus 17,000.00 sta bal.	

TOTAL FUNDS AVAILABLE $31,505,901.14 per BSLF-23-2-12

[illegible] FIGURES EXCLUDE REAL ESTATE (No Real Estate in Squad. II)

ATLAS D

F.E.WARREN MB - SQUAD II

INDEX

ATLAS D

F. E. WARREN MB - SQUAD II

BASIC CONSTRUCTION COSTS

Construction Contracts	$ 14,109,202
Assigned Service Contracts	0
Procurement Contract	1,420,500
Government-Furnished Materials	854,211
Overruns and Underruns	46,782
Suballotments, etc.	30,278
Surveys	0
TOTAL	$ 16,460,973

6

TAB 1
ATLAS D

F. E. WARREN MB - SQUAD II

BASIC CONSTRUCTION COSTS

a. Construction Contracts

5498 Launch Fac & Util, Sq II	$ 12,412,531
5553 Microwave Facility	314,425
5604 Nose Cone Facilities	251,307
5618 Liquid Oxygen Facilities	363,961
5743 Gatehouse & Vehicle Shop	66,934
5836 Water Supply Facil., Site D	79,219
5954 Hq. Wing Rehab (Bldg. 1200)	124,850
6157 Gatehouse & Veh Stg Facil	176,274
6218 Inert Stg Bldg & Rehab	300
6380 Warren I & II Facil Changes	50,072
6381 Warren I & II Facil & Util Changes	64,488
6467 Liquid Oxygen Facil Addition	85,600
6852 Warren I, II, III & FY 59 Facil Changes	119,240

b. Assigned Service Contracts - Negative

c. Procurement
5464 PLS Skid Assemblies $ 1,420,500.00

d. Government-Furnished Materials $ 854,211.00

e. Overruns and Underruns $ 46,781.86

f. Sub-Allotments
Miscellaneous items $ 30,278.28

g. Surveys - Negative

Land

LAND

Negative

Utility Connections

ATLAS D

F. E. WARREN MB - SQUAD II

UTILITY CONNECTIONS

Negative

Mods (Negotiated) Excluding Modifications Covering Claims

TAB 4
ATLAS D
F. E. WARREN MB - SQUAD II

MODS (NEGOTIATED) EXCLUDING MODIFICATIONS COVERING CLAIMS

RECAPITULATION

Mods Negotiated (Over $100,000)

Contract DA-5498		
Mod 8	$ 421,252	
Mod 17	580,580	
Mod 26	137,489	
Mod 98	2,160,974	
Mod 99	257,299	
Contract DA-5464		
Mod 14	308,000	
Mod 19	68,460	
Mod 22	1,621,550	
Mod 29	303,000	
Mod 33	104,101	
		$ 5,962,705
Mods Negotiated (Under $100,000)		1,090,447
TOTAL		$ 7,053,152

TAB 4a
F.E.WARREN MB - SQUAD II
ATLAS D

Negotiated Modification

Contract No. DA-25-066-eng-5498

Modification No. 8

1. Source AFBMD Memo
2. Date 15 Jun 59
3. Received by Contracting Officer 15 Jun 59
4. Presented to Contractor 16 Jun 59
5. Negotiation Completed 10 Oct 60
6. Notice to Proceed 19 Jun 59
7. Cost Estimates

   COC No. --

   Amount $ None

   Initial Government Estimate $ 85,405

   Source Architect-Engineer

   Initial Proposal $ 779,831

   Date 18 Aug 59

8. Negotiated Amount $421,252

9. Remarks: BMD instructions referred to four drawings. Revisions to 117 drawings were involved:
   (a) Move site commander's office and revise kitchen area. Much of the work affected had been accomplished under the original contract plans. The revisions resulted in payment for odd-size doors which had been fabricated but could not be used. Duct work which had been fabricated was revised. Piping and conduit which was embedded in the floor slabs was revised, necessitating coring thru concrete walls for replacement. Collimators in associated guard posts were deleted.
   (b) Tolerances were added to the anchor bolts and beams in the haunched walls of the missile erection area. Steel platforms which had been fabricated under the original contract were enlarged and made heavier. Recesses were added for the beam load points. Slab footings were reinforced. As a result of these changes, 250 pipe sleeves were added and grouted in place, numerous additional pipe

Remarks: Mod. No. 8 (cont'd)

trenches were required and the transition to the central rate station was changed. Anchor bolts were chipped out and reinforcing steel was cut from walls which had been poured. The flexible floor system, for which fabrication was complete under the original contract, was revised considerably. Angle frames through openings being revised were removed by chipping the concrete. Entire frames were thus removed and replaced by grouting. Weld plates in the walls of the missile erection area were revised considerably from that under the original contract. These changes necessitated a considerable amount of additional painting.

(c) Equipment was rearranged, cabinets added; and revisions made to the duct work on the air conditioning unit in the mechanical and electrical room. There were numerous changes to the telephone circuits and telephone cabinets and receptacles.

(d) The horse-power rating required for several motors was revised upward. This resulted in changes in conductors, transformers and shop drawings. All were either ordered or delivered. In many instances selector switches and pressure switches were deleted and replaced by solenoid valves. 9 Launch Service Buildings and 3 Launch Operations Buildings were effected by these changes.

(e) There were several wave guide details added where wave guides were in more or less of a sump. This involved trenching and in some cases installing a big gravel pocket rather than trenching to natural drainage.

(f) Some of the duct work cooling coils were changed in size and capacity which involved new submittal of shop drawings and descriptive data.

TAB 4a
ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng-5498

Modification No. 17

1. Source AFBMD Letter
2. Date 2 Sep 59
3. Received by Contracting Officer 2 Sep 59
4. Presented to Contractor 3 Sep 59
5. Negotiation Completed 26 Jul 61
6. Notice to Proceed 4 Sep 59
7. Cost Estimates

   COC No. --

   Amount $ 100,000

   Initial Government Estimate $ 350,844

   Source Omaha District

   Initial Proposal $ 666,934

   Date 5 Oct 59

8. Negotiated Amount $580,580
9. Remarks : Mod. No. 17 provided wave guide inclosures at all three sites. These wave guide inclosures ran from launch operations building to the three launch and service buildings for each of three sites. They were corrugated metal pipe 24" and 18" which were purchased under Mod. No. 28. They were placed on gravel beds and supported by concrete sleepers which were spaced approximately 4', center to center. There were also runs of two 8" steel pipe which ran thru 30" corrugated metal pipe which had been jacked in place under the LOX Storage Vessel inclosures and jacked into the launch and service buildings and wave guide annex. A wave guide annex was attached to each launch and operations building. A portion of the poured launch operations building wall had to be removed and the foundation pre-stressed by placing beams and jacks in the opening. This opening was later re-poured. Walls of the launch operations building were notched and flashing placed at the joint of wall and annex roof. Anchors were also required to support the annex roof at joint to building.

Negotiated Modification

Remarks: Mod. No. 17 (contd)

This modification also provided for Control Cable Entrances. These entrances were tunneled under the launch operations building wall footings. A portion of the flexible floor system had to be removed and replaced. A large floor area of concrete slab had to be replaced and repoured. Compacted fill had to be excavated and replaced.

Wave Guide pits were installed at transitions of one type wave guide to another type. The pits were similar but much larger than a manhole on the sewer system. Control Cable Ways - these consisted of 10, 14, and 16 five-inch orange board encased in concrete. Road Crossings - where the two systems crossed asphalt paving, the paving had to be cut and replaced later. Excavated material which had been stockpiled had to be removed because the added wave guides cut off access to the stock pile. Manhole #9 was lowered at all sites. Portions of the manhole had been placed in accordance with original drawings.

Lowering of the LOX Area Drain Line - This drain line from the LOX Storage pit had been placed and backfilled. Control cable ducts interferred with original placement and required lowering of the drain line. This also involved lowering and moving of manhole connected with this drain line. Much of the placed piping had to be removed and re-routed in both the launch and service building and the launch operations building, which resulted in core drilling thru concrete walls. There were numerous changes to the duct work and registers which were associated with revisions to equipment layout resulting from the trenches to the launch and service buildings. The grading and paving was revised on the north side of the launch operations buildings. There were several bell vaults which had to be relocated.

TAB 4a
ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5498

Modification No. 26

1. Source AFBMD Letter
2. Date 24 Jul 59
3. Received by Contracting Officer 25 Aug 59
4. Presented to Contractor 8 Sep 59
5. Negotiation Completed 14 Jul 61
6. Notice to Proceed 10 Sep 59
7. Cost Estimates

   COC No. --

   Amount $ 120,000

   Initial Government Estimate $ 123,019

   Source Omaha District

   Initial Proposal $ 143,703

   Date 3 Jan 60
8. Negotiated Amount $ 137,489
9. Remarks : Mod. No. 26 provided a common grounding system for each site; trenching, removal and replacement of paving, core drilling thru the concrete walls and installation of approximately 13,000 linear feet of 4-0 copper cable. This modification primarily covered electrical work.

TAB 4a
ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5498

Modification No. 98

1. Source AFBMD Letter
2. Date 25 Apr 60
3. Received by Contracting Officer 25 Apr 60
4. Presented to Contractor 25 Apr 60
5. Negotiation Completed 7 Aug 61
6. Notice to Proceed 27 Apr 60
7. Cost Estimates

   COC No. —

   Amount $ None

   Initial Government Estimate $ 100,000

   Source Omaha District

   Initial Proposal $ 2,015,963

   Date 10 May 60

8. Negotiated Amount $ 2,160,974
9. Remarks : This modification dealt with faulty valves which were found in the PLS piping during blow down tests. These valves had to be replaced, but they were not readily available. The faulty valves were in accordance with contract specifications. To continue testing on a limited basis, PLS test procedure was altered to the extent that the contractor was required to move from launcher to launcher and back again in order to proceed with the testing. There were also some filter elements which were to remain in the system during blow down tests and later recleaned and reinstalled in the system. This action proved that filters could not be recleaned. Therefore, the testing procedure was altered around the filter, and filter was removed prior to blow down tests and installed later. Since the remaining mechanical work, at the time the faulty valves were discovered, consisted of PLS work, it was determined to be equitable to pay on an actual basis less the estimated cost to complete the remaining work in a normal manner. Method of

Negotiated Modification

Remarks: Mod. No. 98 (Cont'd)

payment has been based on labor, primarily. Also, there were additional test fittings, more hauling of the Dynamic Research recharger units and some additional material which the contractor was directed to supply in order to prevent delays which might result from material that was rejected.

TAB 4a
ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5498

Modification No. 99

1. Source Omaha District Letter
2. Date --
3. Received by Contracting Officer --
4. Presented to Contractor --
5. Negotiation Completed Unilateral
6. Notice to Proceed --
7. Cost Estimates

   COC No. --

   Amount $ --

   Initial Government Estimate $ 13,713

   Source Omaha District

   Initial Proposal $ 5,500,000

   Date 14 Aug 61

8. Negotiated Amount $ 257,299 **(See additional info under Claims)**
9. Remarks

Accelerated impact costs.

All modifications to the contract which had not been fully executed were considered in this analysis. It is a method of determining the costs for completing the modification work without an extension of time. Also considered in this analysis were Clause 5 delays which included costs due to inclement weather and delays resulting from strikes.

Tab 4a
ATLAS D

F. E. WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5464

Modification No. 14

1. Source COC 110
2. Date 24 Nov 59
3. Received by Contracting Officer LAFO 27 Nov 59
4. Presented to Contractor 17 Feb 60
5. Negotiation Completed 6 Jan 61
6. Notice to Proceed 18 Feb 60
7. Cost Estimates

   COC No. 110

   Amount $ 153,000

   Initial Government Estimate $ 186,300

   Source Omaha District

   Initial Proposal $ 328,500

   Date 16 Nov 60
8. Negotiated Amount $ 308,000
9. Remarks

   16 supplements issued

   Mod. No. 14 provided technical manuals and spare parts, removal of Teflon tape, revised vent piping on skids to prevent exterior contamination, installed safety heads, installed filter on fill lines, changed diaphragm material, and added color coding piping.

Tab 4a
ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5464

Modification No. 19

1. Source Omaha District Letter
2. Date 24 July 1959
3. Received by Contracting Officer --
4. Presented to Contractor 24 Jul 59
5. Negotiation Completed 4 Feb 60
6. Notice to Proceed 24 Jul 59
7. Cost Estimates

   COC No. --

   Amount $ --

   Initial Government Estimate $ 64,601

   Source Omaha District

   Initial Proposal $ 68,586

   Date 4 Feb 60
8. Negotiated Amount $68,460
9. Remarks : Mod. No. 19 covered acceleration of work to avoid extending contract time due to excusable delays and reduce time for added work due to issuance of modifications.

TAB 4a
ATLAS D
F. E. WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5464

Modification No. 22

1. Source COC 136

2. Date 25 Jan 60

3. Received by Contracting Officer 8 Feb 60

4. Presented to Contractor 3 Mar 60

5. Negotiation Completed 20 Sep 60

6. Notice to Proceed 9 Mar 60

7. Cost Estimates

   COC No. 136

   Amount $ 250,000

   Initial Government Estimate $ 900,000

   Source Omaha District

   Initial Proposal $ 1,800,000

   Date 20 Sep 60

8. Negotiated Amount $1,621,550

9. Remarks On-site testing, servicing and calibration of the PLS, Sites B, C and D, F. E. Warren MB only.

TAB 4a

ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5464

Modification No. 29

1. Source COC 211-214

2. Date 27 Apr 60 - 2 May 60

3. Received by Contracting Officer 27 Apr 60

4. Presented to Contractor 28 Apr 60

5. Negotiation Completed 20 Sep 60

6. Notice to Proceed 28 Apr 60

7. Cost Estimates

   COC No. 211-214

   Amount $ 47,250

   Initial Government Estimate $ 184,000

   Source Omaha District

   Initial Proposal $ 303,000

   Date 23 Sep 60

8. Negotiated Amount $ 303,000

9. Remarks : Mod. No. 29 covered substitution of Vacco valves for Velan valves for charge and block valves on the PLS skid assemblies.

TAB 4a
ATLAS D

F.E.WARREN MB - SQUAD II

Negotiated Modification

Contract No. DA-25-066-eng- 5464

Modification No. 33

1. Source Omaha District Letter
2. Date 31 Jul 59
3. Received by Contracting Officer --
4. Presented to Contractor 24 Jul 59
5. Negotiation Completed 14 Jul 60
6. Notice to Proceed 24 Jul 59
7. Cost Estimates

   COC No. --

   Amount $ --

   Initial Government Estimate $ 104,595

   Source Omaha District

   Initial Proposal $ 135,175

   Date 30 Apr 60
8. Negotiated Amount $ 104,101
9. Remarks : Acceleration of work to avoid extending contract time due to excusable delays and to reduce the necessary additional time for added work incurred by modifications.

TAB 4b
ATLAS D
F. E. WARREN MB - SQUAD II

MODIFICATIONS NEGOTIATED (UNDER $100,000)

Contract	No.	Amount
DA-5498	89	$ 563,506
5464	44	320,300
5553	9	15,009
5604	15	28,646
5618	16	70,358
5743	2	1,100
5836	5	11,257
5954	3	5,318
6157	6	6,695
6218	0	0
6380	4	2,453
6381	4	54,138
6467	5	9,235
6852	1	2,432
	203	$ 1,090,447

Changes Issued But Not Negotiated (Pending)

TAB 5

ATLAS D

F.E.WARREN MB - SQUAD. II

Negative

Claims (Settled)

TAB 6
ATLAS D
F. E. WARREN MB - SQUAD II

CLAIMS SETTLED

RECAPITULATION

Claims Settled (Over $100,000)		
Contract DA-5498		
Mod 99	$ 4,489,602	
Mod 103	272,352	
Mod 106	595,799	
Mod 107	464,970	$ 5,822,723
Claims Settled (Under $100,000)		9,165
TOTAL		$ 5,831,888

TAB 6a
ATLAS D
F. E. WARREN MB - SQUAD II

Claims (Settled)

(Over $100,000)

1. Contract No. DA-25-066-eng-5498
2. Contractor: Blount Bros. Construction Co.
3. Modification No: 99
4. Source: Contractor
5. Date: March thru November 1961
6. Received by Contracting Officer: March thru November 1961
7. Negotiations Completed: January 1962
8. Contractor's Value of Claim: $6,238,010
9. Settlement Cost:

$4,489,602	(Claim)
257,299	(See Mod 99, Tab 4a)
$4,746,901	

10. Description: Acceleration costs (See Mod 99, Tab 4a for full description) and volume of Type "R" gaseous vessels.

TAB 6a
ADTLAS D
F.E.WARREN MB - SQUAD. II

Claims (Settled)
(Over $100,000)

1. Contract No. DA-25-066-eng- 5498
2. Contractor Blount Bros. Construction
3. Modification No. 103
4. Source Contractor
5. Date 26 Jul 60
6. Received by Contracting Officer 26 Jul 60
7. Negotiations Completed 24 Jul 61
8. Contractor's Value of Claim $286,225
9. Settlement Cost $272,352
10. Description Reclean RP-1 Storage Tanks

TAB 6a
ATLAS D
F.E.WARREN MB - SQUAD.II

Claims (Settled)
(Over $100,000)

1. Contract No. DA-25-066-eng- 5498
2. Contractor Blount Bros. Construction
3. Modification No. 106
4. Source Contractor
5. Date 5 May 60
6. Received by Contracting Officer 5 May 60
7. Negotiations Completed 14 Jul 61
8. Contractor's Value of Claim $920,373
9. Settlement Cost $595,799
10. Description Design deficiencies and acceleration - cryogenic vessels

TAB 6a
ATLAS D
F. E. WARREN MB - SQUAD II

Claims (Settled)
(Over $100,000)

1. Contract No. DA-25-066-eng-5498
2. Contractor Blount Bros. Construction
3. Modification No. 107
4. Source Contractor
5. Date 21 April 1960
6. Received by Contracting Officer 21 April 1960
7. Negotiations Completed November 1961
8. Contractor's Value of Claim $464,970
9. Settlement Cost $464,970
10. Description Recleaning Pressure Vessels

TAB 6b
ATLAS D
F. E. WARREN MB - SQUAD II

CLAIMS SETTLED (UNDER $100,000)

Contract DA-5498		
Mod 109	Reloc Engine Gauge Panels	$2,161
Mod 113	Repair and Replace Roofs	6,101
Mod 115	Evaporator Condenser Slab	903
	TOTAL	$9,165

Claims Validated (Unsettled)

Negative

TAB 7b
ATLAS D

F.E.WARREN MB - SQUAD II

Claims Validated (Unsettled)

Under $100,000

Negative

UNAWARDED WORK

TAB 8
ATLAS D

F.E.WARREN MB - SQUAD II

8. Unawarded Work Negative

CONTINGENCIES

TAB 9
ATLAS D

F. E. WARREN MB - SQUAD II

CONTINGENCIES

One line item is financially active. Contingencies in the amount of $175.47 are contained in the CWE to cover unexpected charges. The financial closeout of Warren II will be made by District Office personnel. It is considered that this amount is very conservative to cover the financial closeout.

GOVERNMENT COSTS

TAB 10
ATLAS D

F. E. WARREN MB - SQUAD. II

GOVERNMENT COSTS

Government costs to 30 April 1962 are $2,139,564. Budqeted costs remaining are $3,147. Additional costs will be incurred in accomplishing financial closeout and preparing various recurring reports and the historical report. In order to prevent an additional reprogramming action, it is considered necessary to retain the present budgeted balance.

POTENTIAL CLAIMS

TAB 12
ATLAS D

F.E.WARREN MB - SQUAD II

Potential Claims - Negative

SECTION 6
ORGANIZATION AND PERSONNEL
CORPS OF ENGINEERS PERSONNEL

Colonel Sidney T. Martin, C.E., was Area Engineer in charge of all missile facility construction in the Cheyenne Area. Colonel Martin was born in Gilmer, Texas, is 46 years of age, attended Texas A&M from 1931 to 1936 and the U.S. Military Academy, West Point, N.Y. from 1936 to 1939. He served with the U.S. Army Corps of Engineers since graduation from West Point in 1939. His service includes duty with U.S. Army Engineer combat and construction units; staff duty at the engineer school, Ft. Belvoir, Va., and the Command and General Staff College, Ft. Leavenworth, Kan.; and five years with Army Corps of Engineers district organizations. In his assignment, he was in charge of a staff of approximately 100 employees supervising the construction of ICBM sites and on-base construction at F.E. Warren AFB, with construction projects programmed in the amount of over 60 million dollars.

Joseph C. Patterson, Assistant Area Engineer, U.S. Army Corps of Engineers Office, Cheyenne Area. Patterson was born at Tacoma, Wash. He was assigned as assistant to the Area Engineer, Cheyenne Area, since May 1958. In his assignment he was top civilian assistant to the Area Engineer, assisting in the supervising and coordination of the many complex problems involved in the ICBM base construction at F.E. Warren AFB.

Donald L. Brown, Chief of the Administration Branch, U.S. Army Corps of Engineers Office, Cheyenne Area. Brown was born at Chamberlain, S.D. His position involved the supervision of 12 employees in the administration branch which includes all property and supply, personnel, mail and records, reproduction, office service administration and other miscellaneous functions for the Corps of Engineers, Cheyenne Area.

William T. Black, Chief of the Engineering and Technical Branch, U.S. Army Corps of Engineers Office, Cheyenne Area. Black was born May 12, 1919 at Tutwiler, Miss., attended high school at Isola, Miss. and graduated from Mississippe State University in 1941. From graduation until 1943, he served as a field engineer for the Tennessee Valley Authority project. From 1944 to 1946, he was assigned as a soldier technician to the Manhattan District, CE. He has served with the Omaha District since 1946, 12 years as a designer of multi-purpose projects and two years on engineering supervision of missile base construction. His position included the supervision of 20 employees coordinating and solving the numerous mechanical, electrical, structural, and civil engineering problems involved in the construction of the multi-million dollar Inter-Continental Ballistic Missile construction program in the Cheyenne Area.

Theodore W. Tritt was assigned as Chief, Construction Branch in the Cheyenne Area Office. Tritt was born at Shelton, Nebr. He attended High School at Shelton, Nebr. and college at Kearney State College, Kearney, Nebr. from 1922 to 1923 and the University of Nebraska from 1923 to 1925. From 1925 to 1931 he worked in general construction business. From 1931 to 1937 he was in a contracting partnership with his father where a large part of his experience was in the bricklaying trade. He has a total of 36 years experience in the construction industry. His assignment in the Cheyenne Area involved performing the field inspection and other general construction and the supervision of a staff of approximately 60 employees on the multi-million dollar Inter-Continental Ballistic Missile Sites in the Cheyenne Area.

Almer C. Engle served as Chief of the Contract Administration Branch in the Cheyenne Area. Engle was born July 24, 1906 at San Antonio, Texas. He attended high school in San Antonio and college at the University of Texas. He was first employed by the United States Government in April 1931 on construction of Randolph Field. He has over 28 years of experience in military construction with the Corps of Engineers in the states of Texas, California, Colorado, Wyoming, Nebraska, Minnesota, North Dakota and South Dakota. He has served as Resident Engineer or Area Engineer on numerous projects. His assignment in the Cheyenne Area involved the supervision of a staff of 10 employees who performed the numerous contract aministration functions in connection with the construction of the multi-million dollar Inter-Continental Ballistic Missile Sites in the Cheyenne Area.

Major James M. Peixotto, CE, served as a special assistant to the Area Engineer in his assignment, performing numerous staff functions and coordination activities in connection with the multi-million dollar Inter-Continental Ballistic Missile Construction program in the Cheyenne Area.

C O P Y

U. S. ARMY CORPS OF ENGINEERS
BALLISTIC MISSILE CONSTRUCTION OFFICE
5651 WEST 19th Street
Los Angeles, 45, California

ENGMA-VA

10 April 1962

SUBJECT: GAO Review of the Administration of ICBM Construction Contracts

TO: U. S. Army Engineer Division, Missouri River, P. O. Box 1216, Downtown Station, Omaha 1, Nebraska
U. S. Army Engineer District, Kansas City, 1800 Federal Office Bldg, 911 Walnut Street, Kansas City, Missouri
U. S. Army Engineer District, Omaha, 6012 U. S. Post Office & Court House, 215 No. 17th St., Omaha 2, Nebraska

1. Inclosed is a copy of a draft report to the Congress of the United States, Subject: "Review of the Administration of Construction of Certain Launch Facilities for the Atlas and Titan Intercontinental Ballistic Missiles at Selected Department of the Air Force Bases" by the Comptroller General of the United States.

2. It is requested that you review the inclosed report and furnish comments on the general and applicable specific portions of the report to this office and to OCE by 15 April.

3. This request has been coordinated with Major General Lampert, OCE. CEBMCO is coordinating with the Air Force Ballistic Systems Division in preparing a reply and OCE is coordinating with Headquarters USAF in preparing a similar reply. It has been agreed with OCE that each element of the Corps involved in this study will furnish theother elements with copies of material prepared.

4. In view of the short date line, it is requested that Districts furnish their replies direct to this office.

FOR THE COMMANDER:

/s/ A. W. SANDERS
A. W. SANDERS
Colonel, Corps of Engineers
Assistant for Operations

1 Incl
as MRD Cy 18
Omaha Cy 19
KC Cy 20

DETAILED COMMENTS 15 April 1962

1. Comments are presented in the general order of the report:

Page 3. Although the contents of the table on page 3 have not been reviewed in detail, particularly with reference to the Air Force initial estimate, it appears possible that some of the large increase in cost over the original estimate for Lincoln Air Force Base, for example, results from the increase in scope of the project from 9 to 12 installations. Provision for this increase at bid price values was made in the original advertisement. This part of the increase should not be included as a part of the cost increases under review.

Pages 4 and 5. The extracts from the prepared statement of the Chief of Engineers constitute an excellent statement of the policy in effect, but the statement was prepared to answer a somewhat different set of questions. It does not fully explain three facts. These are:

a. At the time plans and specifications for each contract was advertised by the Corps of Engineers the plans and specifications were in condition satisfactory to secure adequate competitive bids from all contractors.

b. Except for certain contracts where knowledge existed that one change order of magnitude was expectable, information available to the Corps of Engineers from the Air Force in no way predicted the extremely great number of change orders necessary to update the design because of "concurrency".

c. Knowledge was not available to the Corps that the Air Force would authorize or require "acceleration" and payments for this "acceleration" to prevent impairment of schedules by the numerous change orders and justifiable time extensions.

Pages 5 through 8: These pages outline responsibility for design and construction both before and after the activation of the Corps of Engineers Ballistic Missile Construction Office. To fully understand the participation of the Corps of Engineers in this project and its responsibility prior to 1 August 1960, the following must be recognized:

a. The Air Force through its Air Force Ballistics Missile Division was responsible for the scheduling of the entire project. It established at an early date the dates on which design would be initiated, design would be completed, construction would be started, and construction would be completed. The end dates generally remained inflexible.

b. The Air Force was responsible for the selection of sites. Except in rare instances, the Corps of Engineers did not participate in site selection nor have an opportunity to present its advice on such features as foundation conditions of the contemplated sites.

c. The Air Force was completely responsible for the supervision of design under its contracts with Architect-Engineers. In this capacity the Air Force was also responsible for preparation of modifications or change orders on the contracts after work was under construction.

d. The Corps of Engineers did not participate in scheduling or in the development of design and ordinarily did not see the plans and specifications until they were essentially complete and presented to the Corps of Engineers for review for "construction feasibility". The review by the Corps of Engineers by its Los Angeles Office, with cooperative assistance from the District and Division involved in the specific project, was limited to evaluation of the plans and specifications as to their adequacy for construction feasibility. Decision as to whether the comments by the Corps would be incorporated in the revision of the plans and specifications remained with the Air Force. Many comments were not accepted or implemented.

e. In its absolute control of schedule, as well as design, the Air Force completed the preparation of plans and specifications, in many instances, with a definite knowledge that modifications of considerable scope would be necessary. The Corps of Engineers recommended delay in advertisement of contracts for Warren I and for Titan I to incorporate known changes, or known expected changes. The Air Force, however, ruled otherwise.

f. In general, comments on the plans and specifications by the Corps of Engineers and recommendations for addendum changes resulted in every case in plans and specifications which were adequate for competitive bidding. It was known that plans and specifications were not perfect but they never are where time for design is limited. In some instances it was known that a change order would be involved, but the extremely large number of change orders which developed could not be anticipated.

The attitude of the Corps of Engineers in continuing to use fixed-price contracts was based on the limited information available from the Air Force during the design period. This information in general indicated that as the project was "going downstream" the design was becoming more stabilized. It was reasonable to believe that the 2d and 3d contracts for Atlas and similarly for Titan had been improved and finalized to a degree that changes of a material nature would be unlikely and that the Government interests would best be served by competition obtainable through the use of fixed-price contracts. In retrospect, reimbursable contracts now appear more desirable, but even now facts to prove that they would have been more economical do not exist.

Pages 9 and 10. Reference is made to the contention that award of advertised fixed-price contracts for construction of missile launch facilities did not adequately protect the interests of the Government. The conclusion stated may be correct on "after the fact" examination. Certain of the statements on which it is based are not completely accurate, however. The statement that "the initial specifications were so incomplete and inadequate and the requirements were modified so frequently and to such an extent that ultimately it was necessary for the Corps to abandon the fixed-price. . ." is only partially correct. Even in the case of Warren I which was known at

the time of advertisement to require a major change order for the piping system, the plans and specifications were adequate to secure reasonable and competitive bids. The expected change order was only a small fraction of the total job. Its scheduled date for delivery to the contracting officer was such that the delay on the project was not expectable. Information available to the Corps of Engineers at the time plans and specifications were reviewed in no way indicated the conditions which eventually prevailed as a result of delay by the Air Force in furnishing Modification 20, and the tremendous number of change orders which developed the severe impact on the project work.

"Advertised Fixed-Price Contracts Were Awarded Although Specifications Were Incomplete and Inadequate."

As stated previously, this is not entirely correct. In the case of Warren I it was known that a change order would be necessary to revise the design. Similarly, for Titan I the initial advertisement, delay of which was not permitted by the Air Force, did provide for the issuance of revised drawings to correct incompleteness of the original plans and specifications. Ultimately the modification drawings prepared under the supervision of the Air Force did introduce complications because of inclusion of new changes in design as well as those changes anticipated and provided for by the addendum. At the time of advertisement, however, this definitely was not known to the Corps. In the case of the Lincoln project the possibility of expansion to 12 sites from 9 sites was known and with the assistance of the Corps of Engineers a method for this expansion at bid prices was provided in the original advertisement.

Page 13. As stated previously, because of circumstances known to the Air Force, the Air Force directed that this project be advertised on the scheduled date in spite of the fact that the basic designs of the propellant loading system and the powerhouse were being revised. The addendum issued during the advertising period was intended to establish the basis on which bids would be taken and to establish the basis from which the change in work created by the expected change order could be determined. The actual change order later issued by the Air Force A-E did not correspond exactly with that previously intended and recommended by the Corps of Engineers during the bidding period, inasmuch as it included changes additional to those contemplated at the time of the addendum. The great increase in cost, however, in this project was not solely due to this modification, but the result of many other and later changes developed during the construction period. In addition, a very large modification on this job was provided for in the original addendum at fixed prices as this project included the procurement of equipment to be furnished for the second squadron of Titan I provided that squadron was authorized within a limited period. This additional work increased both the scope and cost but on a competitively bid price. The reason for the inclusion was directed desire of the Air Force to have the equipment identical in both squadrons.

Pages 14 through 17. "Architect-Engineers Had Reservations As To Adequacy of Construction Drawings and Specifications."

It is true that many of the Architect-Engineers who did work on this project were dissatisfied with the quality of the work which they could produce within the time limitations and under the succession of changes that were imposed on them. It is believed that if asked the direct question some of them would state that they were severely handicapped by the fact that their contracts were directed by Air Force personnel who, although very competent Air Force Officers were inexperienced in the supervision of engineering design work under A-E contracts. In this connection the conclusion of the report favoring responsibility under a single agency has merit only if that agency is an experienced construction agency.

Pages 17 through 19. "Indefinite Initial Specifications and Frequent and Extensive Changes Negated any Potential Advance of Advertised Fixed-Price Contracts."

This statement is at least in part inaccurate. It is true that the changes made during the construction period to correct design deficiencies, to add work, or to completely revise features of the construction, placed the Government in a position where fixed price change orders could not be negotiated prior to initiation of work, but it is not true that the scope of work under the initial contract was indefinite. The acceleration costs and impact costs are the factors which were indefinite and almost impossible of resolution. These resulted primarily from changes originated during the construction period and from the insistence by the Air Force on adherence to schedule, regardless of costs. Although the many changes in the contracts necessitated overall settlements after the accomplishment of the work there is no certainty that these projects cost the Government more money than would have been the case under CPFF or other reimbursable contracts. Army Audit Agency Audits show that many contractors lost money even after overall settlements. There is at least a possibility that the contractor's management of these jobs in the interest of their own profits did result in efficiencies in management which might not have occurred under reimbursable contracts. This, of course, is a conjectural statement. However, it is a fact that the contractors would not have lost money under cost plus contracts.

Page 28 - Air Force Study of Changes.

The analysis by the Air Force presented in the table on this page probably correctly shows the percentage of the various types of changes. It has been impossible to review this sufficiently to indicate concurrence or disagreement.

Pages 29 through 31 - Conclusions.

This summary of the conclusions is generally correct. It fails, however, to be entirely accurate in stating that "even though the Corps knew that existing specifications were incomplete and indefinite and had every reason to expect major changes to construction plans" is incorrect. The scheduling of the project, the supervision of the preparation of plans and specifications, the coordination with the missile manufacturers to develop necessary changes in design and the determination of when plans and specifications were ready for advertisement and should be advertised was solely the responsibility of the Air Force. By accident, or intention, the Air Force ordinarily did not utilize the experienced assistance available from the Corps of Engineers during planning or design. The Corps of Engineers, both its Los Angeles Field Office and its operating Districts, did not participate until plans and specifications were available for review on "construction feasibility." Recommendations that the schedule be changed until known changes were incorporated in the plans and specifications were made by the Corps but generally not accepted by the Air Force. The Corps review, however, was adequate to insure that the plans and specifications as issued were adequate for competitive bidding. The Corps had no direct knowledge of the nature or probable extent of changes that would be generated during the construction period. After experience with Warren I many in the Corps were inclined to believe that a different form of contracting might be desirable. However, the long delay between advertising Warren I and Warren II indicated that the Air Force had probably finalized the design sufficiently that changes during the construction period would be negligible. The plans for Warren II and subsequent projects were adequate for competitive bidding.

Page 32. Recommendations.

The recommendation that "Formally Advertised Fixed-Price Contracts Not Be Used When Either the Specifications are Not Sufficiently Complete to Fully Define the Task to be Performed, or There is a Reasonable Expectation that Substantial Changes Will Be Made in These Specifications" is concurred in. To accomplish this, however, the Corps of Engineers as the Construction Agency should be responsible for design and should be a participant in the development of the design and construction schedule. In other types of projects where the Air Force has been responsible for the Weapons System it has utilized the experienced services of the Corps of Engineers for supervision of design and construction. Problems have not been as great as on the ICBM projects.

Pages 33 through 48. "Lack of Centralized Management Coordination and Control Over Administration Adversely Affected the Interests of the Government"

Time has not permitted an exacting review of all the statements on these pages. A few statements can be made, however. These are, first:

a. The Air Force during the period of advertisement for work under the Winger Contract elected to remove the requirement for specifically-named valves on the basis that their new functional type specification was adequate. The Corps of Engineers was not party to the previous testing of valves and did not have access to information on the behavior of the various competitive brands.

b. The leaks in the tanks furnished by Steel and Alloy Tank Company were corrected by a change of design developed by the Corps of Engineers in coordination with the manufacturer after failure to secure a redesign from the design agency. The Corps of Engineers is required by law to evaluate provisions of the contract in force on the basis of the contract and not according to the intention of the designer.

c. In the manufacture of the LOX Tanks for the Titan project problems did arise as a result of errors in the issuance of the addendum. These were further complicated by the actions of the several agencies involved. This expensive change order was, however, a product of the speed with which the project was being executed and not the result of the type of contract.

Pages 30 and 31.

The conclusion that "lack of centralized management for coordination and control of administration resulted in increased cost to the Government which might have been avoided" is not considered correct if it implies that most of the troubles and extra costs would not have resulted if centralized control under the Air Force of all activities had existed. It may be true that improvements in the overall program have resulted since the establishment of the Corps of Engineers Ballistic Missile Construction Office at Los Angeles, California, as a part of the overall activity control office of the Air Force. The improvement in efficiency results not only from the presence of that office, but the fact that projects completed for design since the establishment of that office are farther "down the road" from the original designs and many are in fact simpler, because of elimination of, or changes in liquid fueling systems.

2. Experience with the missile project, as with the many, many projects which have been executed by the Corps of Engineers in the past, shows that a single agency should be responsible for the management of all design and construction. The management agency should be fully participant in the development of schedule. The agency qualified by many years of experience

in managing the design and construction of all types of projects from the munitions plants and atomic energy weapons to air bases, is the Corps of Engineers. If the Air Force had been responsible for the supervision of the weapons manufacture and the development of criteria for the Missile Base installation and the Corps of Engineers had been responsible for supervision of the design of launching and associated facilities by A-Es and the construction of the projects, it is probable that the work could have been done on a more orderly and economical basis. The Corps would then have known the overall problems before being called upon to do the construction work. It could have assisted in the planning and scheduling for maximum efficiency; would have been in a much better position to determine the best "packaging" of contracts; and would have selected the type of contract best suited for each project.

GENERAL COMMENTS

1. The GAO has two principal findings, stated briefly as follows:

a. Advertised fixed-price contracts did not protect the interests of the Government; and

b. Divided management responsibility resulted in additional cost for replacement of equipment and acceleration costs.

2. While the data contained in the report is generally factual (there are some exceptions) in our opinion the data contained in the report does not support the conclusions reached. With respect to the first conclusion the following observations are made:

a. There is no evidence presented that would indicate another method of contracting would have resulted in a lower cost. We surely agree that the administration of this construction program would have been much easier under cost reimbursable type contracts. The contract administration problems under the fixed-price construction contracts were the most difficult ever encountered by the Corps of Engineers. A cost reimbursable type contract would have eliminated most price disputes (by reimbursement) and would have eliminated delays in price settlements (by prompt reimbursement). However, in our opinion this would have made a substantial increase in the construction cost and would obviously have increased the Government costs in connection therewith.

b. The implication that contract settlements were based on "total costs" claimed by the contractor is not supported by the facts. On the contrary, there is ample evidence in the Omaha District (concerning those contracts settled here) that subcontractors and suppliers sustained substantial losses that would not occur under a cost reimbursable contract. These settlements concerned only the protested modifications and claims, without disturbing previous modification settlements or the reasonable cost of the original work.

c. Plans and specifications on which bids were received were sufficiently complete and definite to provide strong competitive bids. The number of bids received and their relation to the Government estimate provides strong evidence that the bidders had a relatively uniform interpretation of the requirements.

d. The cost growth of the contracts was not the result of inaccurate or incomplete initial plans and specifications, but was the result of many changes incorporated into the contract without equitable extensions of time.

3. With respect to the second conclusion, the following is noted:

a. The need for replacement of equipment was not the result of divided management responsibility, but the lack of knowledge to prepare specifications for components that would meet operational requirements. The ICBM program was probably the most complicated engineering project ever undertaken, and developing satisfactory specifications for complicated components could only be accomplished after extensive research and testing. The concept of concurrency is the root of the problem, not only in facility construction but all other phases of the program in its early stages. Primary delays concerning replacement of equipment were not the result of divided management but were due to awaiting further tests on which to base a decision.

b. Acceleration costs were incurred only as the result of inflexible completion dates.

4. The report addresses itself primarily to isolated instances that occurred during the construction phase of the program. The decision to proceed with the program under a concept-of-concurrency was made by Congress at the beginning, and the urgency of the program was established by the National Security Council. The problems cited in the report relating to changes, replacement of equipment and differences of opinion are inherent in any program of this nature and would be found regardless of the type of contract

or the system of management. In our opinion, the report fails to recognize the crux of the problem--that is concurrent research, development, design and construction, together with inviolate completion dates.

5. Specific comments on those items pertaining to the Omaha District are contained in the following pages.

OMAHA DISTRICT
COMMENTS ON GAO REPORT TO CONGRESS
ICBM CONSTRUCTION PROGRAM

The GAO report was received in this office late Wednesday, 11 April. The deadline established for comments permits only 72 hours for accomplishment (Thursday, Friday and Saturday). Obviously this is not adequate time to make a thorough review, and the comments are, therefore, made on the same type of crash basis as the ICBM program was constructed. After submittal our comments will be further reviewed, and supplemented if deemed advisable.

Comments are keyed to the page numbers and paragraphs of the GAO report.

Page 1 - "Introduction" - No comment.

Pages 2 thru 8 - "Background Information"

It is noted that the report covers only that portion of the ICBM program accomplished by the Corps of Engineers under advertised, fixed-price contracts. On Page 3 of the report is a tabulation showing initial Air Force estimates of costs compared to current estimates of costs and indicating "substantial increases in the estimated cost of the construction program". Since a primary finding of the report is a recommendation that formally advertised fixed price contracts should not be used for this type of construction, it would appear that a similar comparison of those phases of the program accomplished under cost reimbursement contracts would be necessary to evaluate adequately the cost increase and to place the facility construction problems in proper perspective.

Page 9 - "Findings and Conclusions."

Par. 1. "Award of Advertised Fixed price contracts - - - did not adequately protect the interests of the Government".

Do not concur. (See comments below).

Par. 2. The GAO report states that initial specifications were so incomplete and inadequate and the requirements modified so frequently

and to such an extent that ultimately it was necessary for the [illegible] to abandon the fixed prices and instead to negotiate contract prices on the basis of the total cost claimed by the contractors for the work performed. A review of the bids and the Government estimate on Facilities at Warren contradicts the contention that the specifications were incomplete and inadequate. Fourteen bids were received on the Warren I project, with less than a 10% spread between the first six bids. Bids on Warren II and Warren III likewise showed close competition and a uniform understanding of the requirements. In addition, pre-bid conferances were held for prospective bidders on all ICBM Launcher contracts in the Omaha District. Questions from bidders were solicited and answers provided at the meeting were later confirmed by addenda prior to bid opening. The significant changes to the contract that resulted in substantial increases were due to developments of the missile. Changes required to eliminate errors and conflicts in the specifications and drawings would not have made a substantial increase in the cost of the contract. The difficulties in negotiating firm prices on modifications were not caused by inadequate initial plans and specifications; the difficulties were caused by numerous changes in the originally designed Launching Facilities without adequate extensions of time, and the inability of either the contractor or the Government to isolate and identify acceleration costs incurred by successive and overlapping modifications.

Page 10 - Par. 3. As indicated above, we do not agree that the plans and specifications were not sufficiently definite or stable to permit effective competition. The bids received on the Warren and Lowry jobs were close, competitive, and within normal relation to the Government estimate.

Page 11 - Par. 2. Statement - "It was planned that additional work on the Propellant Loading System would be added by modification to the contract when firm designs and plans were available".

This statement is not correct insofar as the Omaha District is concerned. The plans and specifications as issued defined the Propellant Loading System except for the Propellant Loading Skids (transfer units). The drawings indicated the skids in dotted outline, with a notation "to be installed by others". The design for the Propellant Loading Skids was not complete at the time the Warren I job was advertised but there was no apparent reason at that time to assume that the skids could not have been installed by separate contract, as was accomplished on the Warren II, Warren III and Offutt jobs.

Page 12 - Par. 2. "The designs, drawings, and specifications for components of the Propellant Loading System were not complete at the time, including those for skid assemblies, pipe anchors, guides and supports, expansion joints, and the control system and permanent cleaning facility."

Installing the Skid Assemblies by Modification 20 to the prime contract in lieu of a separate contract was necessary due to major changes in the balance of the Propellant Loading System. The installation of the pipe anchors, guides and supports was a requirement developed after completion of the original design. No permanent cleaning facility was required on Warren I.

Page 16 - Par. 1. "BMD instructed ADL to specify components by manufacturers' names for the first Vandenberg installation and later, for the second Vandenberg and Warren I, directed that the term 'or equal' be added to the specifications."

Specifications for Warren I required components by manufacturer's name, "or equal", as initially advertised; however, we were instructed to delete the words "or equal" by addendum prior to bid opening.

Page 18 - Par. 1. " - - - The Corps had resorted to the use of contract change orders issued unilaterally by the Contracting Officers and settlements negotiated on the basis of total costs as the only practicable methods

available to avoid work interruptions and to achieve equitable contract settlements."

Insofar as the Omaha District is concerned, the statement is entirely untrue. The Corps did not issue modifications unilaterally to eliminate the burden of processing and adjudicating claims and appeals that might result from attempts to negotiate price adjustments. Unilateral modifications issued in the amount of the Government estimate were the result of failure to reach price agreements with the contractor. However, price agreements were reached on individual modifications for 63 of the 115 at Warren I, 61 of the 100 issued on Warren II, and for all 91 modifications issued on Warren III. In addition, price agreements were reached on all modifications to contracts for support facilities at the Warren complex. There is no instance in the Omaha District where price adjustment for a modification was made on the basis of "total costs".

Page 19 - Par. 1. This paragraph gives the impression that settlements based on total costs would result in payments to contractors in many millions of dollars that they would not otherwise be entitled to, and such settlements were made without examination of the contractor's cost records. The report further states that the Corps was required to obtain price settlements for advertised fixed price contracts through negotiation on the basis of contractor's incurred cost without (1) knowledge of information supporting the bid price; (2) the right to require cost records to be maintained; (3) the right to examine such records as may have been kept; and (4) such other controls as are available to the administrative agency under contracts awarded through negotiation. In most cases where final settlement was based on the "fair and reasonable cost" approach, information was available concerning the bid prices from the records of the contractors concerned, by comparison of the contractor's bid prices with those of other bidders, and by comparison

to the Government estimate. Although our contracts did not give the Government the right to require contractors to be maintained, such records were, in fact, maintained, and although we had no right as such to examine contractors' cost records, no such settlement was considered until the prime contractor and all subcontractors and suppliers involved in a dispute or a claim consented to audit by the Army Audit Agency. The Army Audit Agency made complete and comprehensive audits of all of the costs incurred by the prime contractors, subcontractors and suppliers that were involved in claims or disputes. Settlements made by the Omaha District have revealed that substantial losses were incurred by construction firms and suppliers that were not recoverable under this "fair and reasonable cost' settlement. There is no evidence that any other method of contracting would have resulted in a lower cost to the Government. To the contrary, it would appear that under a cost reimbursement type contract these firms would have not incurred financial loss.

Page 21 - Par. 1. The payment of the difference between the labor costs actually incurred and the Government estimates of total labor cost did not constitute an arbitrary disallowance of a like amount to compensate the Government for errors and delays for which the contractor was considered responsible, as indicated in the report. The payment constituted a partial payment to the contractor, with a balance held in reserve pending a more complete study of the acceleration costs.

Page 21 - Par. 2. Statement - "One of these studies, however, indicated that Fuller had underestimated labor costs in its original contract bid by about $1,600,000."

The GAO reporter apparently took a work paper being used by one of the negotiators as a basis for discussion with the contractor. Citing of this single work paper out of context does not permit proper weight

to the many other studies conducted substantiating that there was no appreciable error in the contractor's bid. The method of settlement used, in which a number of bids are averaged to determine the fair and reasonable cost of the original work, eliminates any possibility of paying for an error in bid.

Page 22 - Par. 2 contains the statement that "the Corps had withheld payment of $808,500 negotiated for certain modifications not requiring accelerated operations." The four modifications making up the amount referred tp were negotiated on the basis of accelerated work under the particular modification.

Page 29 -"Conclusions"

We do not agree that it was recognized prior to award of contracts that existing specifications were indefinite. The plans and specifications were definite and "biddable" as to construction requirements at the time the bids were taken. This is supported by the examination of the bids received and the Government estimate. At the time bids were taken, the plans and specifications, though containing more errors and discrepancies than found in such documents prepared under normal procedures, were sufficiently complete and definite to permit preparation of firm bids. We do not agree that the Omaha District had every reason to expect major changes in the construction plans. Such statements can only be made in retrospect.

Page 30 - Par. 2. The statement occurs in the lower part of the page, "Further, since the degree of control under such conditions does not compare with that under certain types of negotiated contracts, a contractor is relatively free to incur costs as it deems necessary, with reasonable prospects of being reimbursed for its incurred costs plus an amount for profit."

We do not agree that contractors felt relatively free to incur costs as they deemed necessary, with reasonable prospects of being

reimbursed. As evidence of the contractors' concern over their ability to recover costs, they arranged for a hearing before the "Sheppard" Committee in February 1961 to emphasize their concern and plead for assurances that they wo uld recover their costs. In settlements made by the Omaha District there are many instances where contractors did not recover the costs they had incurred. The settlements made by the Omaha District preserved the "reasonable cost of the original work" and made deductions for inefficiency, physical errors and other items not considered reasonable.

Page 32 - Par. 2. Contract settlements by the Omaha District on the "reasonable cost basis" were made only after appropriate cost data had been obtained through the use of comprehensive audits by the Army Audit Agency. The settlement agreements, however, which have already been executed, do not provide for access by the General Accounting Office to all records relating to the contract.

Page 33 - Par. 1. Statement - "The Air Force, its architect-engineers, the Corps of Engineers, and its contractors in some instances could not reach mutual and timely agreement concerning statements of work and interpretations of specifications." Prior to issuing modifications to the contract involving design changes by the architect-engineers, change order conferences were convened in which representatives of the Air Force, the architect-engineer and the Corps of Engineers reviewed the proposed change prior to its issuance. After the change was issued to the contractor, the sole responsibility for administration of the change and adjustment of the price rests with the Contracting Officer. Only the Contracting Officer has the authority and responsibility to make decision in accordance with the terms of the contract.

Page 33 - Par. 3. The statement pertaining to the Corps settling contractors' claims for increased costs, in spite of objection to the Air Force and its architect-engineers seems to overlook the fact that the basic

responsibility for administration for the construction contract was vested in the Contracting Officer, not in the Air Force and not in the architect-engineers. The Contracting Officer in each instance cited did include the views of the Air Force in his evaluation of factors relating to the claims as well as other pertinant factors, and his decisions were based upon this total evaluation. It is significant that the Air Force objections to the proposed settlements were based upon what they intended by the specifications rather than on an impartial evaluation of what was actually specified. The proclivity for individuals, bearing no legal responsibility, to criticize or differ with actions of responsible officers is characteristic of most undertakings and is not limited to the ICBM program nor to construction.

Page 34 - Par. 2. Although there were some difficulties in the manufacture and testing of the Velan valves, these problems were resolved and the valves did meet the requirements of the specifications, including testing requirements under the Winger contract. Complete test reports are available to demonstrate this. Results of these tests were furnished to the Air Force. The tests conducted in the Winger plant at Ottumwa, Iowa, were witnessed by the contractor's independent testing laboratory, the Government's independent testing laboratory, the Corps of Engineers personnel and Air Force personnel. The valves would not meet the operational test referred to on Page 36 of the report (Environmental Testing), which was not a requirement of the specifications, and for this reason were replaced at Government expense.

Page 35 - Par. 3. This office has no knowledge of Velan's request to the Arthur D. Little Company to comment on problems experienced with the specifications for tests under the Winger contract. No record is readily available to indicate that the matter had been referred to the Corps of Engineers.

Page 35 - Last paragraph. The statement concerning excessive leakage

of the valves and the problems of operating the valves is misleading. Difficulty was experienced in operating the valves - consequently the contractor was requested to furnish a listing of the required torque for closing the valves against various specified pressures. The information was furnished and all valves on the skids were operated with torque wrenches, utilizing the torque recommended by the manufacturer. When operated in this manner, all valves successfully passed the leakage test required under the Winger contract. These tests were conducted after the valves had been installed in the completed piping systems within the skid assembly. The torque valves were high due to the hard materials specified for the valve seats.

Page 36 - Par. 4. The Omaha District was furnished the results of tests on two valves tested by the Air Force under this program. Those tests results indicated that the tests, as performed, had important differences from the requirements of the Winger contract as follows:

a. The Air Force-conducted tests seated the valves with 50 pounds of torque compared to the 70-90 pounds specified by the valve manufacturer.

b. The test gas used was helium rather than the specified air or nitrogen gas.

c. The test conducted on one valve involved welding of pipes to each end of the valve. This welding was accomplished with the stem and disc in a closed position in the valve, contrary to the manufacturer's recommendations. It is our opinion that this procedure may have distorted the valve seat and caused the large leakage experienced. The second valve was tested in a clamped fixture and no welding performed. This also cast doubt on the validity of the test, in view of the 6,000 pounds of pressure used. Neither test was performed at the manufacturer's recommended torque, and this is an important deviation, considering the hardness of the specified valve seat. It is our understanding that the Air Force-conducted tests were not

intended to determine compliance with the contract plans and specifications but to determine operational requirements. The replacement valves that were finally specified by the Air Force were materially different, and would not have complied with the original plans and specifications.

Page 37 - Par. 2. The statements attributed to the Technical Director of the New York Testing Laboratory, Inc., are in direct contradiction to the test reports signed by the same Technical Director. Copies of test reports signed by the Technical Director are on file, certifying that the valves met the minimum leak requirements of the Winger contract. One such certification was executed before a Notary Public on 26 June 1959.

Page 38 - Par. 2. With reference to the $607,500 replacement cost of 504 Velan valves on the Winger contract, it should be noted that all Velan valves had been installed in the skids and all skids were installed in the PLS System at the Launcher Sites when the Air Force made the decision to replace the valves. The Air Force- specified Vacco valves that were placed in the system were of a different type, meeting a different specification, and far more expensive than the Velan valves removed.

Pages 39, 40 and 41. The manufacturer of the cryogenic vessels also fabricated and assembled the vacuum and instrument piping for the vessels, in accordance with the contract plans and specifications. In using the prescribed Swagelok fittings on the vacuum line and the specified rupture disc on the vessels, the contractor was unable to meet the 7-day evacuation test. After repeated attempts to meet the evacuation test requirements and a thorough investigation by Government representatives, it was determined that the specified fittings and rupture discs were not adequate to meet the contract requirements under the evacuation test. The contractor was instructed to use a sweated fitting in lieu of the specified Swagelok type, and a flanged spring-loaded relief valve in lieu of the specified rupture discs. After the change was made, the contractor (in December 1959) was ordered to

accelerate his operations to overcome the delay. Both the Air Force and the architect-engineer contended that the originally specified components were suitable, notwithstanding the fact that the manufacturers of these components stated they were not suitable under the pressures imposed. The Contracting Officer agreed to reconsider his original decision (allowing costs in connection with this delay) until the Air Force could present additional data. The views of the Air Force were fully considered by the Contracting Officer, along with other factual data in connection with this dispute, in arriving at his final decision. There were no legal ambiguities involved in this dispute; the Contracting Officer's legal position in connection therewith can be amply supported by considerable legal precedent. This is to the effect that when the Government specifies in detail the design to be followed in manufacturing equipment and also specifies performance requirements for the equipment, the contractor is entitled to relief if the Government-specified design will not meet the performance requirements.

Pages 44 to 48 - Records are no longer available in the Omaha District on which to base complete comments concerning the Lowry project. Jurisdiction for the Lowry project was transferred to CEBMCO about 15 Sept. 1960. The following comments are based on memory of personnel involved at the time:

Page 46 - Last paragraph. The statement is made, "According to internal Corps Memorandum, legal representatives of the Corps made a similar interpretation."

The Omaha District Counsel does not agree that there was an internal Corps Memorandum wherein legal representatives of the Corps made an interpretation that shock requirements would not result in additional costs.

Page 48, Last paragraph. The statement is made, "In October 1960 the Corps' Omaha District Counsel determined that the January 15, 1960 decision of the prior Contracting Officer - - - could not be overruled". In October 1960 the Lowry project was under the jurisdiction of CEBMCO and the Omaha

District Counsel had no authority to give opinions to the Contracting Officer. The determination was probably made by the General Counsel of CEEMCO. The Omaha District Counsel does not disagree with the opinion.

NCDWC (10Apr62) 1st Ind
SUBJECT: GAO Review of the Administration of ICBM Construction Contracts

U. S. Army Engr Div, Mo Riv, Omaha, Nebr., 15 April 1962

TO: U. S. Army CHMACO, AF Unit P.O., Los Angeles, 45, California

1. The comments being furnished by the Kansas City District and the Omaha District are concurred in. Because of lack of time the comments of both Districts have been limited. For the same reason comments of this office will be general in nature and except in specific instances limited in detail.

2. The General Accounting Office report contains three recommendations based on its conclusions. They are:

a. That the Secretary of Defense not use formally advertised fixed-price contracts when either the specifications are not sufficiently complete to fully define the task to be performed, or there is a reasonable expectation that substantial changes will be made in the specifications.

b. That the Secretary of Defense before settlement of existing formally advertised fixed-price contracts on a total cost basis, require the contracting agency to obtain appropriate cost data and perform appropriate audits thereof and to require that settlement agreements contain specific provisions for access by the General Accounting Office to all records relating to the contracts and their settlement.

c. That some change be made in the centralized responsibility for and management of administration of construction contracts to secure more direct coordination of technical problems among the Air Force, its Architect Engineers, the Corps and its contractors.

3. These recommendations are based on the following conclusions:

a. That the Corps of Engineers advertised fixed-price contracts when, because of knowledge of inadequacies in the plans and specifications, the reimbursable type of contract should have been used.

b. That settlement of acceleration and impact costs under the contracts in force has been made without full knowledge of costs.

c. That divided responsibility has not been completely eliminated by the establishment of CHMACO and [illegible] and that further organizational changes are desirable.

4. The report contains considerable justification for the recommendations and for the conclusions on which they are based. The manner in which the analysis

is presented and the fact that the GAO review was limited to the Corps of Engineers construction operations could lead to an erroneous overall conclusion and decision.

5. The Missile Construction Program has been a very complex one. The numerous misfirings of missiles which one reads of in the newspapers proves the complexity of the weapon and explains the numerous facilities changes which have been necessary in developing the permanent military installations. It seems probable that if factors now known had been known to the Chief of Engineers at the inception of this program, many contracts would have been performed as CPFF or other form of reimbursable contract. It seems true also that if the many problems areas now known had been known, the Chief of Engineers might not have accepted responsibility for construction with no control of schedule or design. The conclusion that control and management of design and construction should be under one agency is justified. Because of the great effect of contractual problems on cost, the agency responsible for construction should be the agency responsible for design. The Corps of Engineers is the agency which by known experience over many years has successfully designed and constructed projects of great complexity. It is the logical agency to supervise design as well as construction of the fixed facilities of a major program such as the Ballistics Missile project. Similarly, the Air Force, with its experience with the development and manufacture of airplanes is the agency with experience in the establishment of criteria for the fixed facilities. Until the missile program the Air Force had little experience in the management of design or construction contracts.

6. The report indicates that the present BSD and CEBMCO organization is not fully satisfactory to GAO. Change to centralize control will effectively meet the stated requirements only if CEBMCO gains responsibility for design and participation in scheduling.

7. If errors have occurred in the selection of the type of contract these errors have resulted from lack of knowledge on the part of the Corps of Engineers at the time of advertising contracts that design changes of great number and scope with heavy impact on construction costs would continue to be generated during execution of contracts following the initial contracts. The original scheme outlined by the Air Force was that initial construction of proto-types for all weapons would be conducted at Vandenberg Air Force Base and that follow-on construction of the operational bases would be straight-forward with minimum deviation from the construction at Vandenberg. This concept has not developed. It may in the future as the new Weapons Systems become less complicated. In the meantime CEBMCO can determine the most effective type of contract for each project, provided CEBMCO can determine the probable nature and extent of changes expectable for each project.

MRDVG 1st Ind 15 April 1962
SUBJECT: CAO Review of the Administration of ICBM Construction Contracts

8. The report implies but does not prove that the interests of the Government have not been served by the form of contract used and the methods of settlement which were resorted to. It is very possible, nevertheless, that cost to the Government has been as low, or lower than could be obtained by other contractual methods as the "know-how" and profit motives of experienced contractors has been utilized. It is known that many of the contractors and sub-contractors not only made little profit but in many cases suffered severe losses which are not attributable to their own bidding or inefficiency. This is equivalent to saying that any type of cost plus contract could not have resulted in lower costs to the Government; however, such a contract would, in retrospect, have had many advantages, such as greater flexibility and ease of management. If any changes result from this report, they should take a form that will give the Chief of Engineers an opportunity to participate in the program in a manner which would more definitely utilize the full experience of the Corps of Engineers in the scheduling, design and construction of fixed facilities.

9. Although experience has shown that plans and specifications for the early missile projects were greatly revised by many change orders, the plans and specifications for the projects in the Missouri River Division were known at the time of taking bids to be adequate to secure fair, sound and competitive bids. The bidding record shows this to be a fact. The impact of change orders, not the initial bidding situation, is the reason for now considering a reimbursable type of contract as possibly preferable.

10. In the final settlement of contracts on an overall basis both the Omaha and Kansas City Districts utilized the services of the Army Audit Agency for review and analysis of contractor costs before settlement of the portion of the contract not previously resolved in the settlement of individual modifications.

11. Limited detailed comments are contained in the inclosure hereto.

FOR THE DIVISION ENGINEER:

ROBERT S. PALMER
Colonel, Corps of Engineers
Deputy Division Engineer

1 Incl
1. w/d
Added: Incl 2
2. as

CC: OCE (dup) ✓

JOINT MESSAGEFORM

SECURITY CLASSIFICATION: UNCLASSIFIED

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ACTION: PRIORITY			X	X	X	
INFO:						

SPECIAL INSTRUCTIONS

FROM: Hq USAF

TO: CHIEF OF ENGRS DEPT OF ARMY WASH 25 DC ZEN

UNCLAS AFOCE-3 79607

Subj is GAO Draft Report on Review of Administration of Construction of Certain Launch Facilities, Atlas and Titan. Reference discussions between representatives of our respective construction divisions on the preparation of comments on report. Understanding that our two construction divisions will work together informally in the preparation of the paper to be forwarded to OSD by Sec AF. Further understood the C of E inputs to the paper will be formally submitted to Sec AF through Sec Army. May 4 has been set as the date for presentation of a coordinated paper to Sec AF. AFSC has been requested to furnish inputs by 25 April. Suggest your field agency inputs be available at the same date. This will allow our offices the period 26 April - 4 May for preparing and staffing a coordinated paper. Request confirmation.

ACTION: ENG
INFO: DCSLOG
DA IN 730710

DATE	TIME
17	0900
MONTH	YEAR
April	1962

WRITER

SYMBOL: AFOCE-CS

TYPED NAME AND TITLE (Signature, if required): Mr. R. B. Bishop

PHONE: 71975 | PAGE NR.: 1 | NR. OF PAGES: 1

SECURITY CLASSIFICATION: UNCLASSIFIED

RELEASER

SIGNATURE: [signature]

TYPED (or Stamped) NAME AND TITLE:

BEN A. SCARBROUGH
Colonel, USAF
Ass't Chief, Construction Division
Directorate of Civil Engineering, DCS/C

DD FORM 173 MAY BE USED REPLACES DD FORM 173, 1 OCT 49, WHICH WILL BE USED UNTIL EXHAUSTED

JOINT MESSAGEFORM

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HQ. USAF

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	BOOK	MULTI	SINGLE			
ACTION PRIORITY		X		AF	X	
INFO						

FROM: HQ USAF

SPECIAL INSTRUCTIONS

ZEN-3

TO: AFSC ANDREWS AFB MD

INFO: BSD LOS ANGELES CALIF

CHIEF OF ENGRS DEPT OF ARMY WASH 25 DC ZEN

79501

UNCLAS AFOCE-3

AFSC FOR SCM, CH. OF ENGRS FOR ENGM-C. Subj is GAO Draft Report on Review of Administration of Construction of Certain Launch Facilities, Atlas and Titan. Request your comments, together with detailed supporting information, on findings, conclusions and recommendations set forth in subject report. To insure submission of completely coordinated Air Staff response within time limitation imposed, your comments must arrive this Hqs, Attn: AFOCE, no later than close of business 25 April 1962.

ACTION: ENG

DA IN 730486

21 3 22 APR 62

DATE	TIME
16	1400
MONTH	YEAR
April	1962

WRITER

SYMBOL: AFOCE-CS

TYPED NAME AND TITLE (Signature, if required): Colonel M. R. Reilly

PHONE: 54443 | PAGE NR. 1 | NR. OF PAGES 1

SECURITY CLASSIFICATION: UNCLASSIFIED

RELEASER

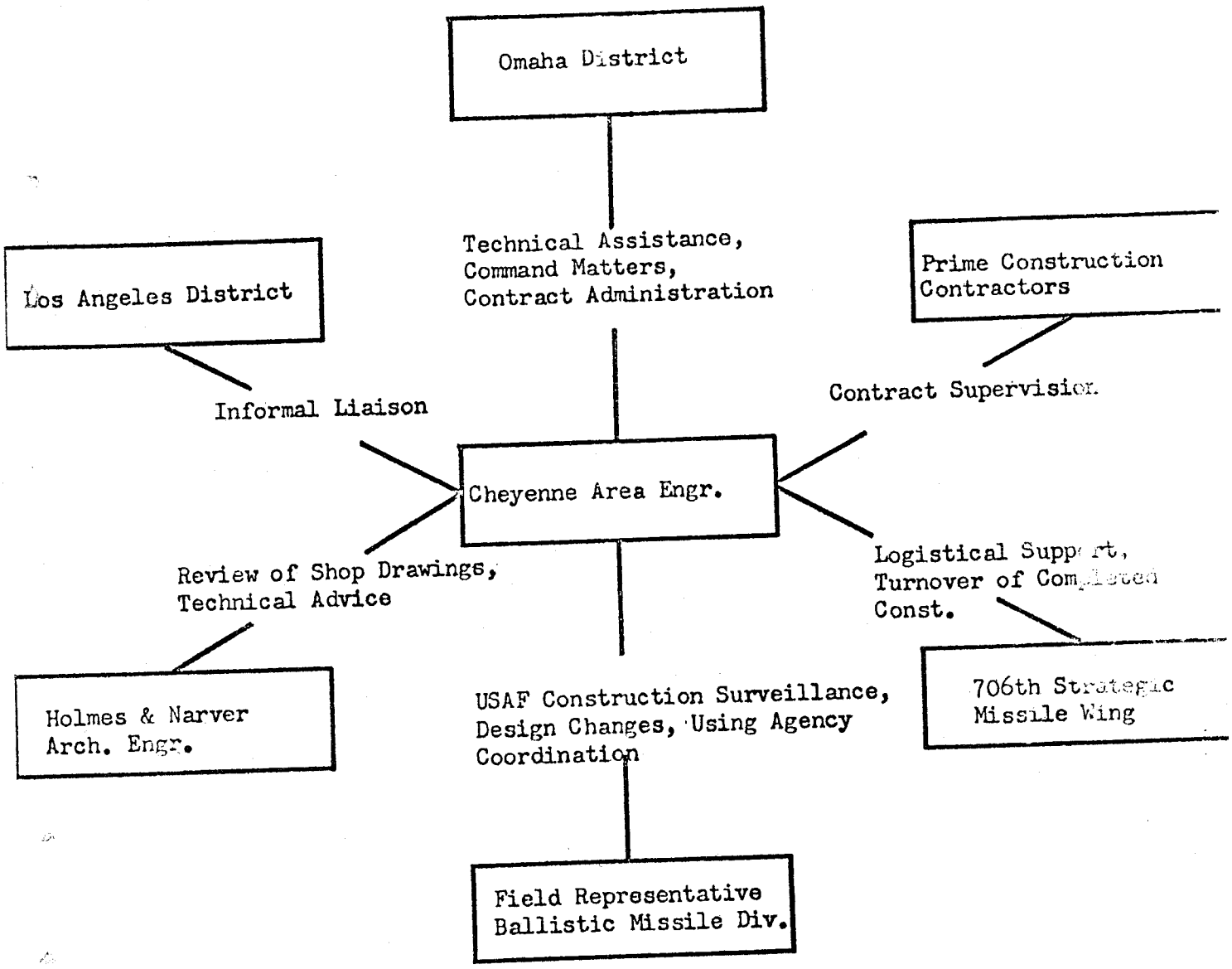
SIGNATURE: R. H. Curtin

TYPED (or stamped) NAME AND TITLE

R. H. CURTIN
Brigadier General, U. S. Air Force
Deputy Director for Construction
Directorate of Civil Engineering, DCS/O

DD FORM 1 MAY 55 173 REPLACES DD FORM 173, 1 OCT 49, WHICH WILL BE USED UNTIL EXHAUSTED

Cheyenne Area Engineer
Relationship With Other Agencies



SECTION 7
CHRONOLOGICAL HISTORY
Warren AFB Missile Installations

Notified by telephone of siting trip 22-25 Oct 1957 and soils and survey requirements on 16 Oct 1957. Soils and survey data required by 15 Dec 1957.

a. Survey and prelim soils data forwarded 29 Nov 57 with remaining soils data forwarded 12 Dec 57.

b. Data submitted 29 Nov 57 lost and resubmitted 18 Dec 57.

Design by District of Access Roads, Sites A and B started 10 Jan. Siting of C road not firm.

Additional soils data, Sites A and B requested 10 Jan 58 due to shift of positions. Furnished 31 Jan on a.

Guidance Facil Site A, prelims received 18 Jan 58 and received in conference 6 Feb 58.

Site C relocated 30 Jan 58.

Design of access roads revised from 22 to 24 feet by AFBMD 24 Feb; Design of A complete 10 Mar and B 20 Mar.

Conference 24 and 25 Mar 58 in Cheyenne gave general siting for Site D (on northerly portion of Base) and schedule for topo - 1 May on "D" and 15 May on "C".

Design of Access Roads Sites D (on base) and C started 11 Apr 58.

Final design of guidance bldg (Site A) (less utilities) received 19 Apr 58 advertised 25 Apr 58. Coordinated review concurrent with reproduction and advertising.

Launch Operations Bldg Site A prelims received 26 April. Originally scheduled 17 Mar 58.

Work on Site "D" (on base) held in abeyance 5 May 58.

As of 6 May 58 utilities for all bldgs, site A,were being scheduled for completion 16 June and advertised separately from Launch Operations and Launch and Service Bldgs. Pressure exerted to keep packages together.

As of 6 May 58 design and advertising for Site "B" scheduled to follow site "A" by 30 days.

30-35% in progress plans for Launch Operations Bldg review in conference 6 May 58. Holmes and Narver to complete design without support utilities. Launch and Service Bldgs not to be submitted for any review but Omaha Dist personnel to review in H&N office, 15-22 May during design.

Addendum No. 1 to Guidance Bldg received 12 May and issued 15 May.

Plans and specs of Launch and Service Bldgs, partially reviewed in Holmes & Narver office 19-21 May. Not developed sufficiently to start review by 15 May as scheduled and not sufficiently complete to make a good review.

On 21 May decision made to consolidate plans and specs by volumes for Launch Operations Bldgs, Launch and Service Bldgs and Utilities in one advertising package and delivered by volumes from 28-31 May. Power Plant, Heating Plant, PLS Skids including PLS piping anchorage, expansion and structural supports and PLS skids not in package. PLS System to be added by mod and promised by about 1 Aug 58. No design completion dates for Power Plant and Heating Plant. Power Plant being sized for size 1600-1750 KW diesel-powered generators.

Launch Facilities and Utilities package received on schedule, advertised 9 June with bid opening scheduled 8 July. Power plant design completion target last of June.

Informal information from BMD 24 May indicated sites B and C would be reduced in size by deleting the west 1320' of each site. Work at Site C held in abeyance.

Design instruction 9 Jun 58 to Holmes & Narver to Power Plant provided for supply specification for 4 generators with expansion to six with building to be designed to accommodate generators supplied.

Addenda review conference held for Launch Facils & Utils 10-13 June. Required complete revision in electrical distribution system with major change in floodlighting and pumping facilities.

17 Jun 58. Site D relocated from on-base to SW of Cheyenne with primary and alternate sites under consideration and work on C to proceed.

Specification stencils for precurement of Engine generators for Power Plant due 3 Jul 58 received 11 Jul 58. Unacceptable and had to be redrafted in joint BMD, LADE, OD conference on 21 and 22 July. Advertised 25 July with bid opening 21 Aug.

New concept criteria for Squadron II (3 Launchers on 3 sites B, C & D) furnished in conference 29 Jul 58.

Primary site D selected and staked for drilling on 11 Aug 58.

Representative of A. D. Little Company visited office on 6 and 7 Aug to discuss format etc. for PLS Skids they are designing for BMD to be used for Squadron II, Sites B, C and D.

Access Road, Pumping Facils and Perimeter Fence for Site C advertised 7 Aug with bid opening 7 Sept.

Modification No. 1 to Launch Facils and Utils, reorienting Launcher No. 4 due this office 1 Aug received 12 Aug 58.

Advertisement of facilities for Site C cancelled 21 Aug. Access Road to be by BPR. Balance of work to be added to main facility advertisement.

Foundations reports for Squadron II, scheduled to be forwarded from OD, 29 Aug, delayed by lack of criteria - received from BMD on 2 Sep 59 and reports forwarded 12 Sept.

Verbal instructions received on 4 Sep to proceed with surveys for Squadron III (3 x 3) Sites E, F and G with an alternate site for E.

Joint conference held in Area Engineer's office 9 Sep 58 to consider General Electric and Burroughs final review comments on Guidance Facilities (Plans had been furnished those offices in April).

Prelim plans for Site B received 24 Sep. Bldgs to be same for C & D.

Change order conference held in Cheyenne 23 Oct covering PLS revisions, heating for Guidance Fac - miscellaneous changes. Schedule for Power Plant furnished, complete design 15 Jan 59-have 1st generator on line by 1 Jul 59 - considered an impossible schedule as normal construction would be 8 mos with 1st generator on line by 1 Sept.

SECTION 8
DELAYS - STRIKES
STRIKE DATA, ATLAS SQUADRON II
WARREN AIR FORCE BASE

1. On Saturday, 13 June 1959 at 1330 hours, the carpenters walked off the job at all sites and returned on Monday morning, 15 June 1959.

2. On 7 October 1959, seven cement finishers walked off the job at Site "D" and returned to work on 10 October 1959.

3. At Site "D" on 29 December 1959, all of the electricians walked off the job. This was apparently done as a protest by these electricians (employed by Blount) against Flora Construction Company (non-union prime contractor under Contract DA-5836). These electricians returned to the job Monday morning, 4 January 1960.

4. On 3 February 1960, 30 skilled workers and two laborers at Site "B" and 17 skilled workers and 1 laborer at Site "C" of the mechanical subcontractor walked off the job because of a reorganization of the supervisory setup. As a result, 6 workmen were discharged and the remaining workers reported back to the job later that day or the next day.

5. On 7 March 1960, Burke Moving and Storage (under contract to the mechanical subcontractor) were restrained by Plumbers and Steamfitters Local 192 from unloading a vessel on rail siding. Dispute was settled when two fitters from mechanical subcontractor were assigned to assist with unloading of vessels.

6. Picket lines representing all crafts were placed on Sites "B", "C" and "D" at 0700 hours on 24 March 1960, 312 men affected. The strike was because of a dispute between the unions and Convair concerning the provisions of the Davis-Bacon Act predetermined wage conditions. The strike ended at 1630 hours on 25 March 1960 by receipt of formal notice

from the Air Force to Union Organizations that provisions of the Davis-Bacon Act would be included in all Air Force contracts. Personnel returned to work at 0800 hours on 26 March 1960.

7. Thirty-three (33) electricians and six (6) foremen walked off the job at Site "D" at 1330 hours on 1 April 1960 because their Site Superintendent had been demoted to General Foreman and their General Foreman had been demoted to Working Foreman. The job was fully manned at 0930 hours on 4 April 1960.

8. On 13 April 1960, at 0745 hours, the Cement Masons Local Union 299 set up picket lines at Sites "B", "C" and "D" because Wallace Process Piping was working Cement Finishers 40 hours per week and other crafts overtime 7 days per week. The contractor agreed to work Cement Finishers the same number of hours as the other crafts, and by 1230 hours on 13 April 1960, employees were beginning to return to work at Sites "B", "C", and "D".

9. At 0700 hours on 12 May 1960, IBEW Local Union 415 established picket lines at Sites "B", "C", and "D" against Convair and associated subcontractors. Placards read that Davis Bacon rates were not being paid by Air Force Installation Contractors. Two hundred seventy-eight Blount Brothers and 78 Winger employees involved. Removal of Picket lines was ordered by international IBEW effective 1800 hours 18 May 1960.

10. A strike by the IAM against Convair idled 115 Blount Brothers employees and 64 Winger employees for the entire day on 6 June 1960. On 7 June 1960, the building trades union ignored the picket lines and reported back to work.

11. Due to wage disagreements between Laramie Construction Company and Operating Plasterers and Cement Masons Local Union No. 299, the union

F. E. WARREN - SQUAD II

1.	Contract Number:	DA-25-066-eng-6157.
2.	Contractor:	Laramie Construction Co. Cheyenne, Wyo.
3.	Brief description of the work:	Construction of Gate House and Vehicle Storage Facilities, Sites B, C and D.
4.	Using Service:	Air Force
5.	Final or estimated final contract cost:	$182,969.31
6.	Date work stoppage began:	5-12-60.
7.	Date work was resumed:	5-19-60
8.	Man-days lost:	65.
9.	Number of work days lost:	6.
10.	Union or craft involved:	All crafts.
11.	Brief description of the cause of the stoppage:	A.F. contractor, Convair, in dispute over Davis-Bacon Rates.
12.	Total number of workers involved:	13.
13.	Overtime work to recover time lost by work stoppage, in man-days:	None.
14.	Cost, if any, to the Government, for the additional overtime:	None.
15.	Number of days the contract was extended due to each work stoppage:	10.
16.	Number of days need date slipped due to work stoppage:	None.

F.E. WARREN - SQUAD II

1.	Contract Number:	DA-25-066-eng-6157
2.	Contractor:	Laramie Construction Co., Cheyenne, Wyoming
3.	Brief description of the work:	Construction of Gate House and Vehicle Storage Facilities, Sites B, C and D.
4.	Using Service:	Air Force.
5.	Final or estimated final contract cost:	$182,969.31
6.	Date work stoppage began:	6-6-60
7.	Date work was resumed:	6-7-60
8.	Man-days lost:	28.
9.	Number of work days lost:	1.
10.	Union or craft involved:	All crafts.
11.	Brief description of the cause of the stoppage:	Convair I.A.M. strike, B.T.C. honored I.A.M. picket lines 1 day.
12.	Total number of workers involved:	34.
13.	Overtime work to recover time lost by work stoppage, in man-days:	None.
14.	Cost, if any, to the Government, for the additional overtime:	None.
15.	Number of days the contract was extended due to each work stoppage:	None.
16.	Number of days need date slipped due to work stoppage:	None.

NOTE: Delay was concurrent with off-site strike which delayed progress and for which contractor received a time extension.

F. E. WARREN - SQUAD II

1.	Contract Numer	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of work	Construction of Launch Facilities and Utilities Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	12-15-59
7.	Date work was resumed	12-16-59
8.	Man-days lost	58
9.	Number of work days lost	1
10.	Union or craft involved	Fitters and Electricians
11.	Brief description of the cause of the stoppage	Crafts refused to work with non-union workers
12.	Total number of workers involved	58

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief Description of the work	Construction Launch Facil and Util., Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	10-7-59
7.	Date work was resumed	10-10-59
8.	Man-days lost	21
9.	Number of work days lost	3
10.	Union or craft involved	Cement Finishers
11.	Brief description of the cause of the stoppage	Wanted improved working conditions.
12.	Total number of workers involved	7
13.	Overtime work to recover time lost by work stoppage, in man-days	862
14.	Cost, if any, to the Government, for the additional overtime	$36,620
15.	Number of days the contract was extended due to each work stoppage	None
16.	Number of days need date slipped due to work stoppage	None

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil and Util., Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	2-3-60
7.	Date work was resumed	2-4-60
8.	Man-days lost	46
9.	Number of work days lost	1
10.	Union or craft involved	Fitters and Laborers
11.	Brief description of the cause of the stoppage	Employees returned to work when foreman (cause of trouble) was discharged
12.	Total number of workers involved	48

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil. and Util., Squadron II
4.	Using Service	Air Force
5.	Final Contract Cost	$22,415,068
6.	Date work stoppage began	3-24-60
7.	Date work was resumed	3-26-60
8.	Man-days lost	675
9.	Number of work days lost	2
10.	Union or craft involved	All
11.	Brief description of the cause of the stoppage	Air Force contractor picketed because of Convair
12.	Total number of workers involved	323

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil and Util. - Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	4-1-60
7.	Date work was resumed	4-4-60
8.	Man-days lost	64
9.	Number of work days lost	3
10.	Union or craft involved	Electricians
11.	Brief description of the cause of the stoppage	Delay in assigning new electrical crew
12.	Total number of workers involved	39

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil and Util. - Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	4-13-60
7.	Date work was resumed	4-13-60
8.	Man-days lost	135
9.	Number of work days lost	One-half
10.	Union or craft involved	All
11.	Brief description of the cause of the stoppage	Cement finishers want overtime
12.	Total number of workers involved	263

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil and Util. - Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	5-12-60
7.	Date work was resumed	5-19-60
8.	Man-days lost	1,946
9.	Number of work days lost	6
10.	Union or craft involved	All
11.	Brief description of the cause of the stoppage	Air Force contractor, Convair, in dispute over Davis-Bacon rates
12.	Total number of workers involved	278

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil and Util. - Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	6-6-60
7.	Date work was resumed	6-7-60
8.	Man-days lost	112
9.	Number of work days lost	1
10.	Union or craft involved	All
11.	Brief description of the cause of the stoppage	Convair IAM strike. BTC honored IAM picket lines one day
12.	Total number of workers involved	115

F. E. WARREN - SQUAD II

1.	Contract Number	DA-25-066-eng-5498
2.	Contractor	Blount Bros. Construction Co. Montgomery, Ala.
3.	Brief description of the work	Construction of Launch Facil and Util. - Squadron II
4.	Using Service	Air Force
5.	Final contract cost	$22,415,068
6.	Date work stoppage began	6-21-60
7.	Date work was resumed	6-27-60
8.	Man-days lost	2,165
9.	Number of work days lost	6
10.	Union or craft involved	All crafts
11.	Brief description of the cause of the stoppage	Picket and walk-off due to non-union ready-mix concrete on one job
12.	Total number of workers involved	411

PROBLEM AREAS

Following is a list of areas that have produced problems in the construction of the facilities for the Cheyenne Missile Squadrons:

1. Modification of Contracts. The number of and scope of the changes to contracts have complicated the completion of work on a timely basis and the administration of the contracts.

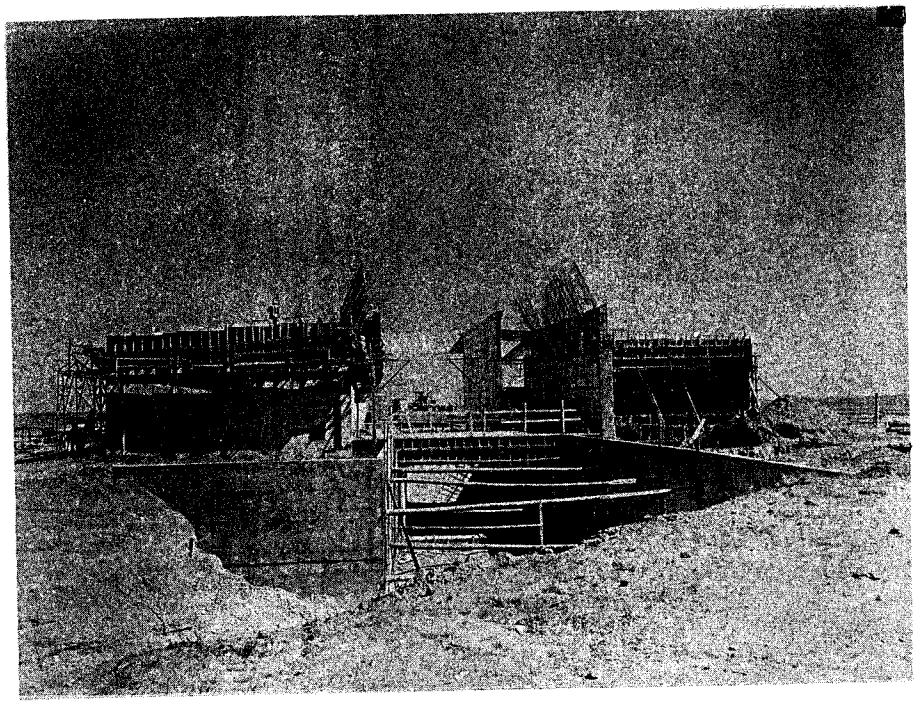
2. Labor Difficulties. Work stoppage due to labor difficulties presented a constant problem. The Cheyenne Area was a "fringe" area with respect to labor with lower wages than metropolitan Denver and with a work force inflated with transient personnel the Area does not attract the highest type craftsmen.

3. Delivery of Critical Materials. The timely delivery of manufactured items of material taxed to the limit both contractor and Government expediting personnel. This problem was aggravated by changes to the contract involving long lead items and changes to the contract issued late in the contract.

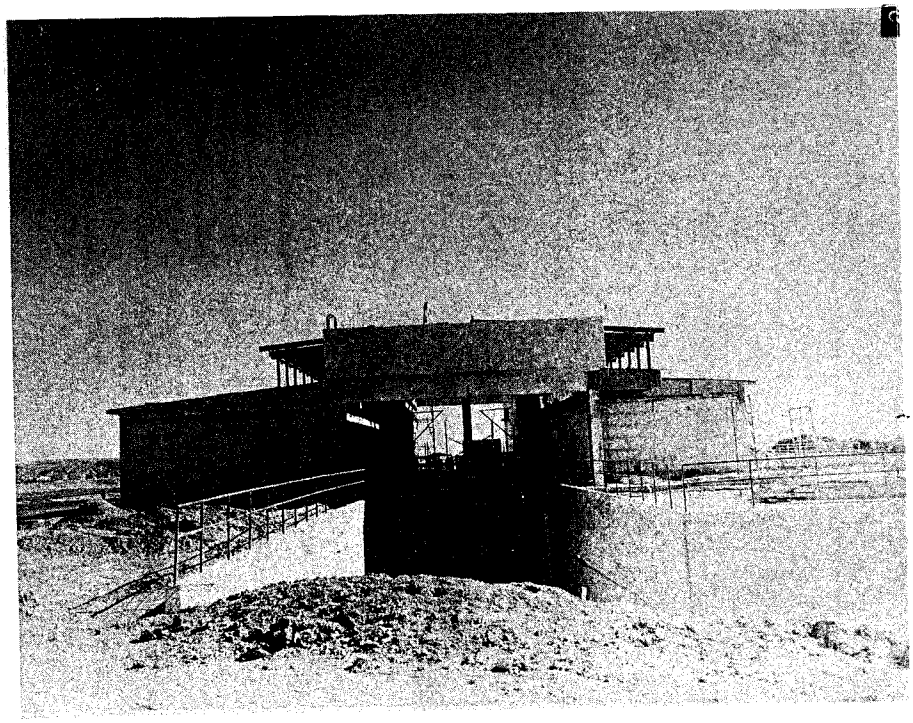
4. Repair and Modifications to Government Furnished Propellant Loading System Skids. This area involved correction to the skids as a result of shipping damage, correction of manufacturer's mistakes, and correction of skids to meet modifications not performed prior to the shipment of skids.

5. Control System Testing. This testing was accomplished to determine if the specified components of the control system for the propellant loading system met the requirements of the Weapons System. From a practical point of view the program approached a research and development effort.

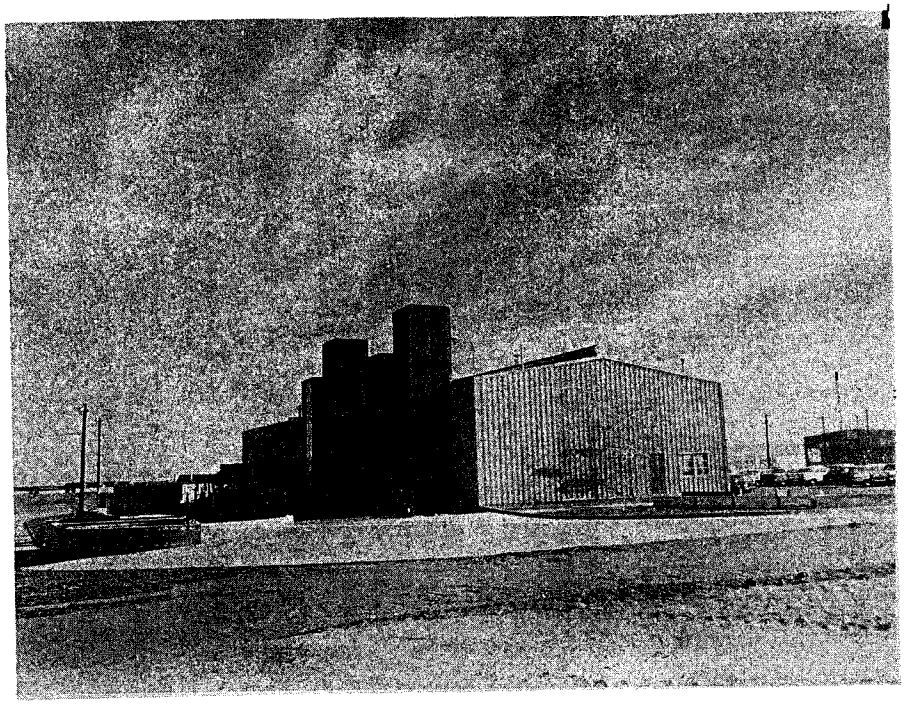
6. Low Concrete Strengths. This problem developed during construction which required the production of concrete with a strength of 4000 pounds per square inch. Intensive investigations indicated the most likely causes to be the use of marginal aggregates and a lack of adequate batching control.



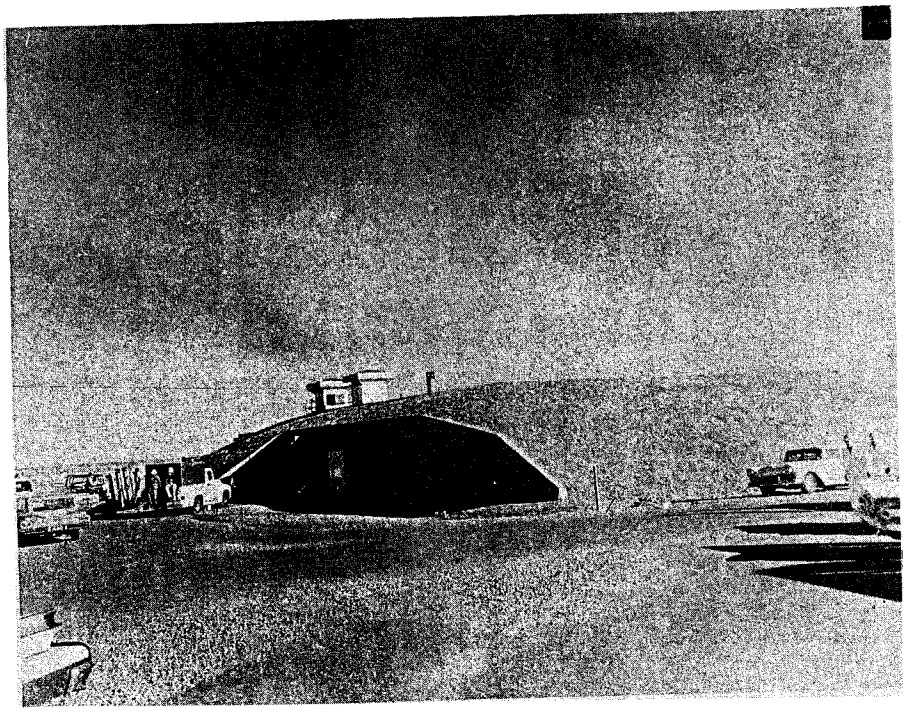
Date: Sep 14, 1959, DA-5498, F.E.Warren AFB,Launch Fac & Util, Squad II. Site C, Launcher #3, view looking east shows roof slab forming rooms #102 and 103.



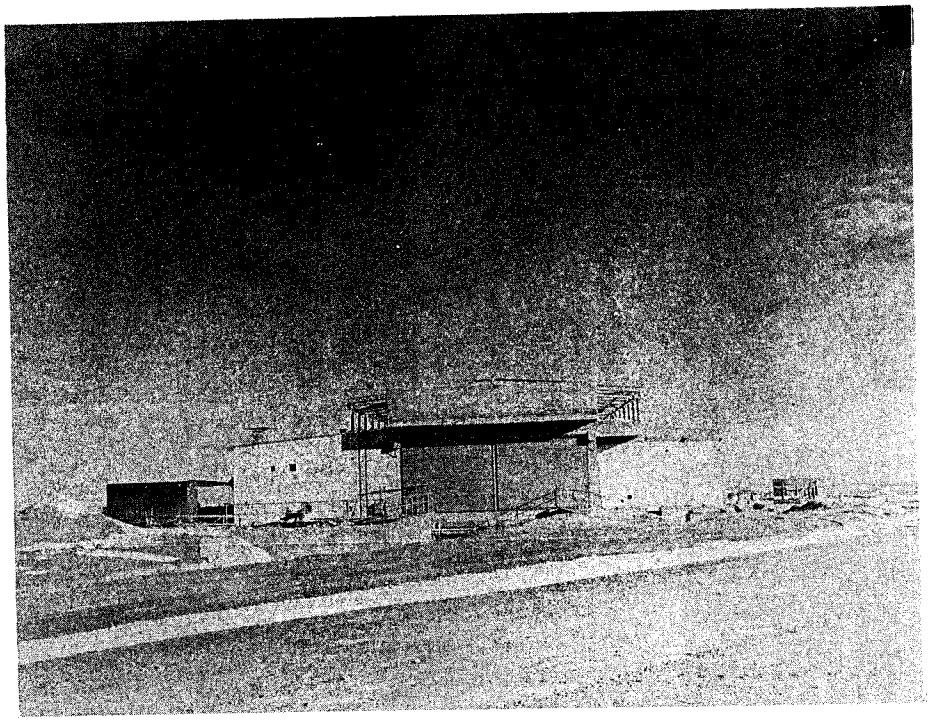
Date: Oct 21,1959, DA-5498,F.E.Warren AFB Launch Fac & Util Squad II. Site C, Launcher #1, view looking east shows the flame pit area with the protective railing around the waste channel walls.



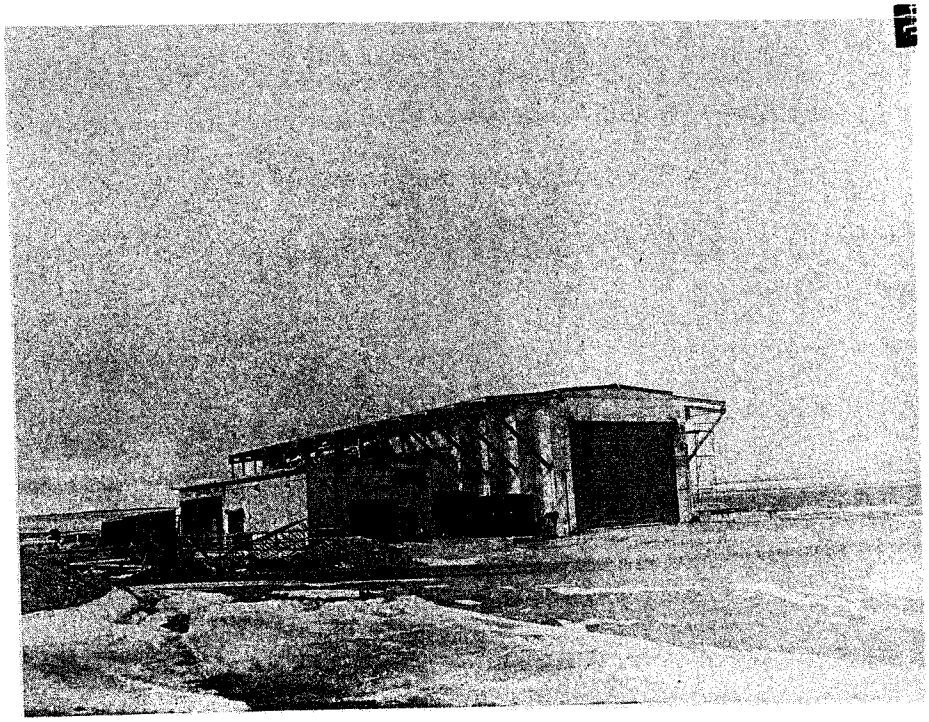
Date: Nov 30, 1959,DA-5618,Liquid Oxygen Facil,F.E.Warren AFB. Liquid Oxygen Building, view looking east southeast showing the north end of the liquid oxygen building with the head exchanger towers and the liquid oxygen tank pedestals.



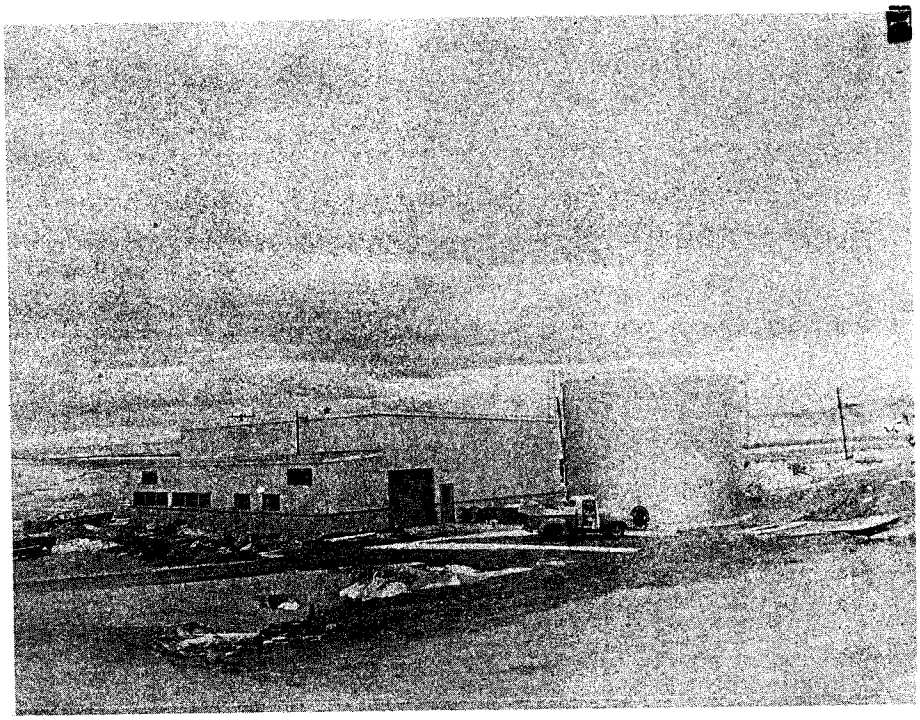
Date: Dec 2, 1959,DA-5064,F.E.Warren AFB,Launch Facil, Site "A". View, looking northeast, shows completed West Operations Building.



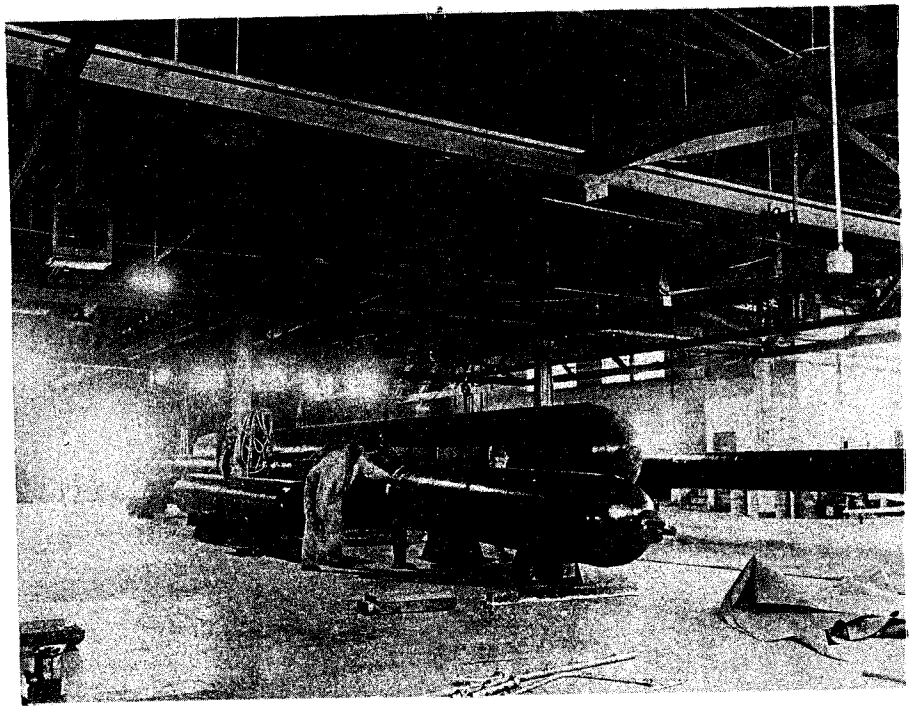
Date: Jan 19, 1960,DA-5498,F.E.Warren AFB Launch Facil Squad II Site C, Launcher #3, view looking east shows flame pit, GOX, and Nitrogen Areas. Tanks and skids have not been placed.



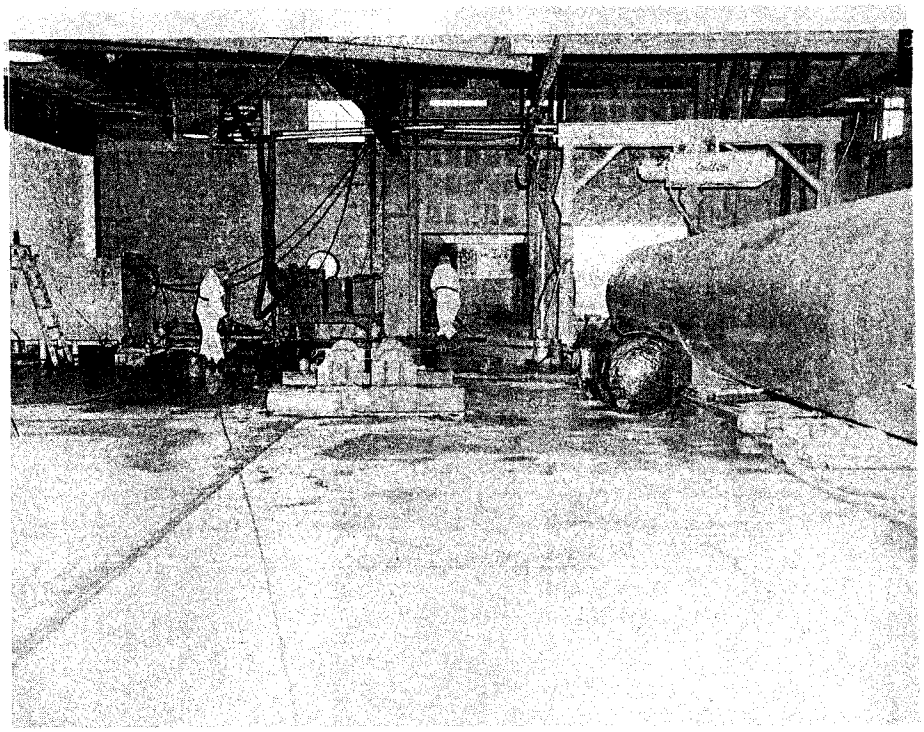
Date: Jan 25, 1960, DA-5498,F.E.Warren AFB Launch Facil,Squad II. Site D,General view looking northwest shows completed Launcher #1 structure. Waiting installation of Liquid Oxygen storage and PLS installation.



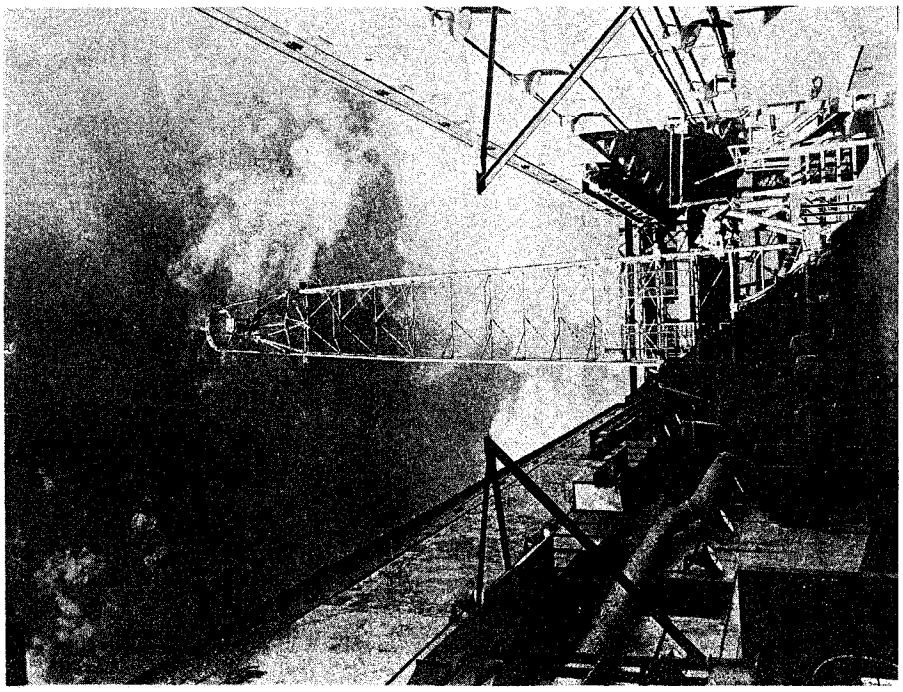
Date: Jan 25, 1960,DA5498,F.E.Warren AFB Launch Facil Squad II. Site D - Power Plant. View looking southwest, showing power plant bldg. exterior complete except for power cable trench, backfill and painting.



Date: Feb.9, 1960, DA-5498 F.E.Warren AFB Launch Facil Squad II. Sites B,C & D - Plan-a-Tex Cleaning plant. View looking north showing main bay storage area with tanks awaiting cleaning.



Date: May 4, 1960, DA-5498,F.E.Warren AFB Launch Facil Squad II. PlanaTex Cleaning plant. General view of area affected by tank explosion.



Date: Sep 15, 1960, DA-5498 F.E.Warren AFB Launch Facil Squad II. Site B, Launcher #2. View looking east showing missile boom in vertical position.