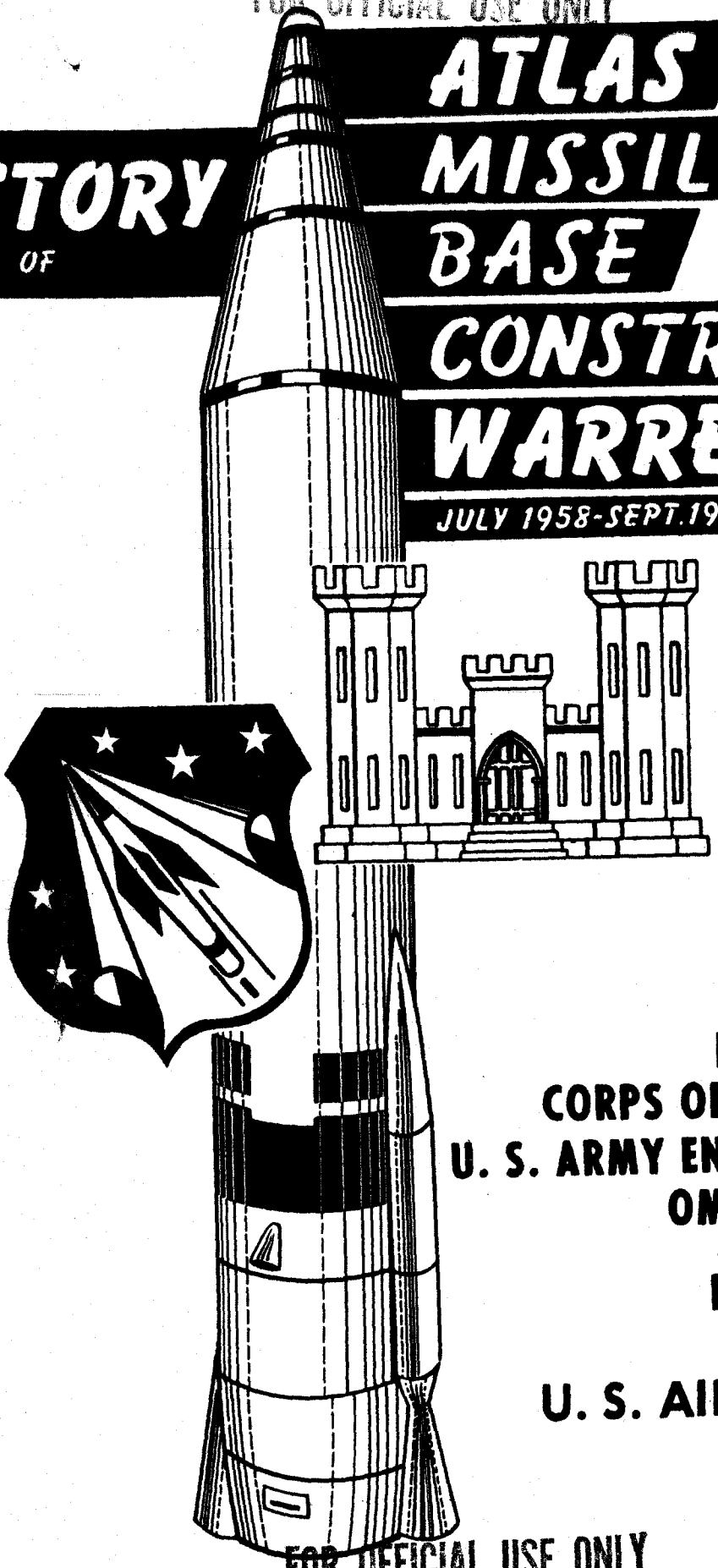
XVIII-13 SB
14-2

FOR OFFICIAL USE ONLY

HISTORY OF ATLAS MISSILE BASE CONSTRUCTION WARREN I

JULY 1958-SEPT. 1959

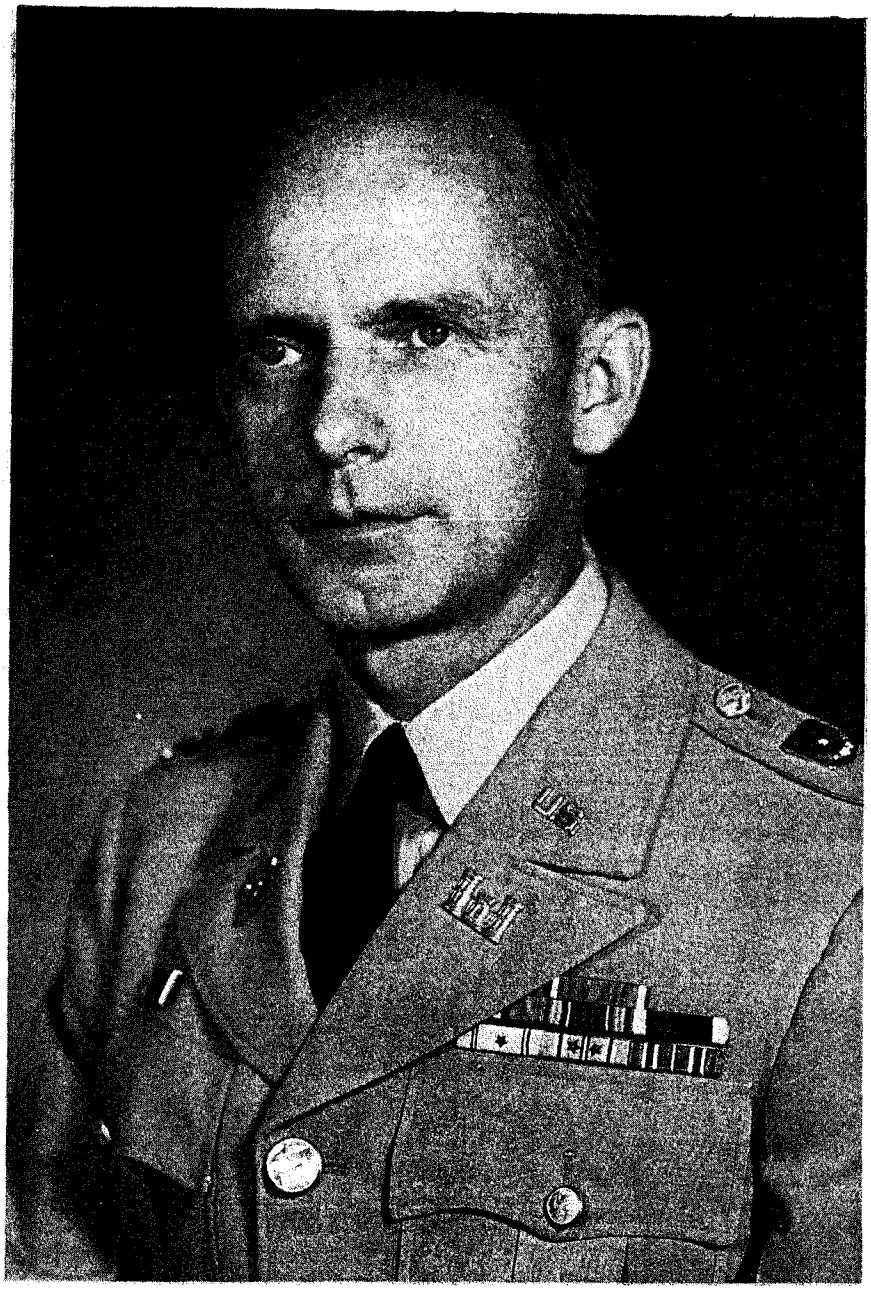


BY
CORPS OF ENGINEERS
U. S. ARMY ENGINEER DISTRICT
OMAHA

FOR

U. S. AIR FORCE

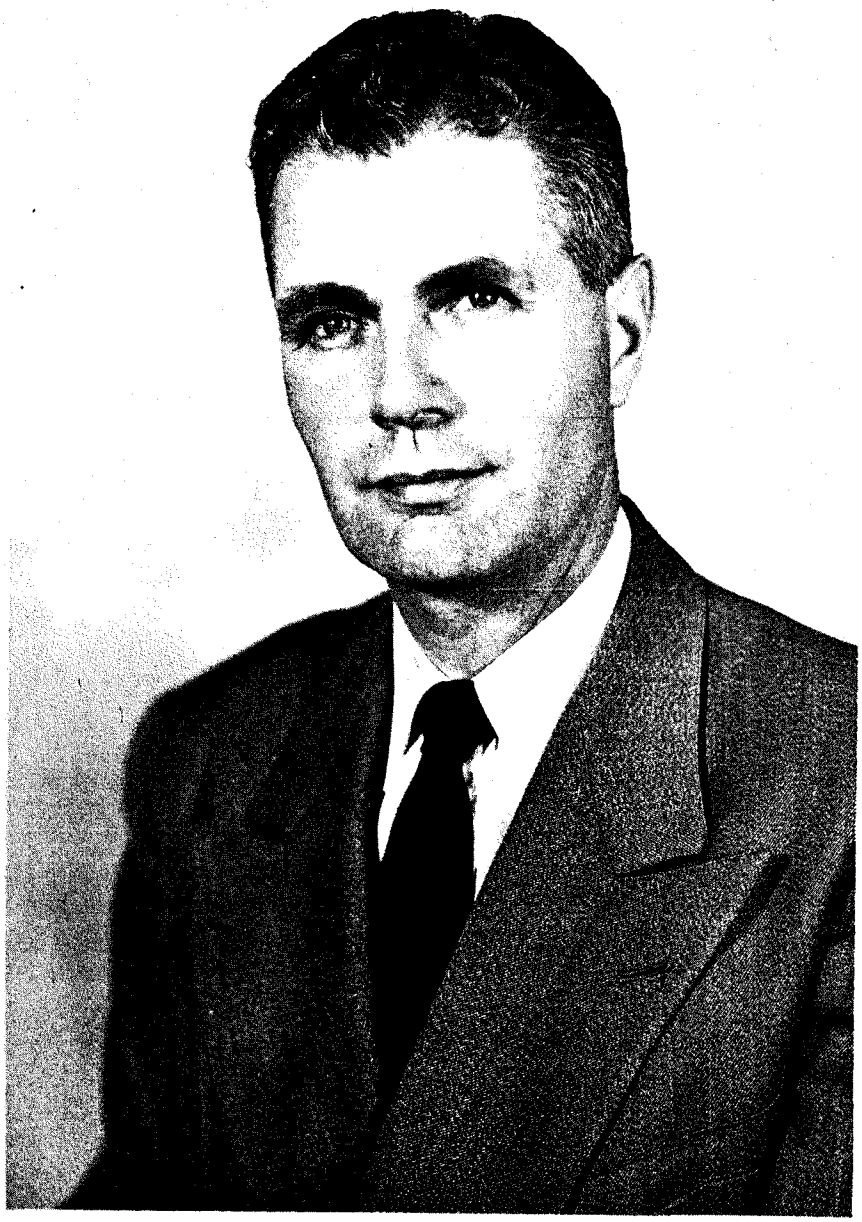
FOR OFFICIAL USE ONLY



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

HISTORICAL SUMMARY REPORT

OF

MAJOR ICBM CONSTRUCTION

Prepared by

T. A. Coffey

and

M. A. BADTKE

APPROVED BY:

L. L. Price

Chief of Construction Division

FOR OFFICIAL USE ONLY

WARREN I

INDEX

SECTION I

DESCRIPTION OF REPORT

Squadron I, F. E. Warren Missile Base, was the first fully operational United States Intercontinental Ballistic Missile Squadron.

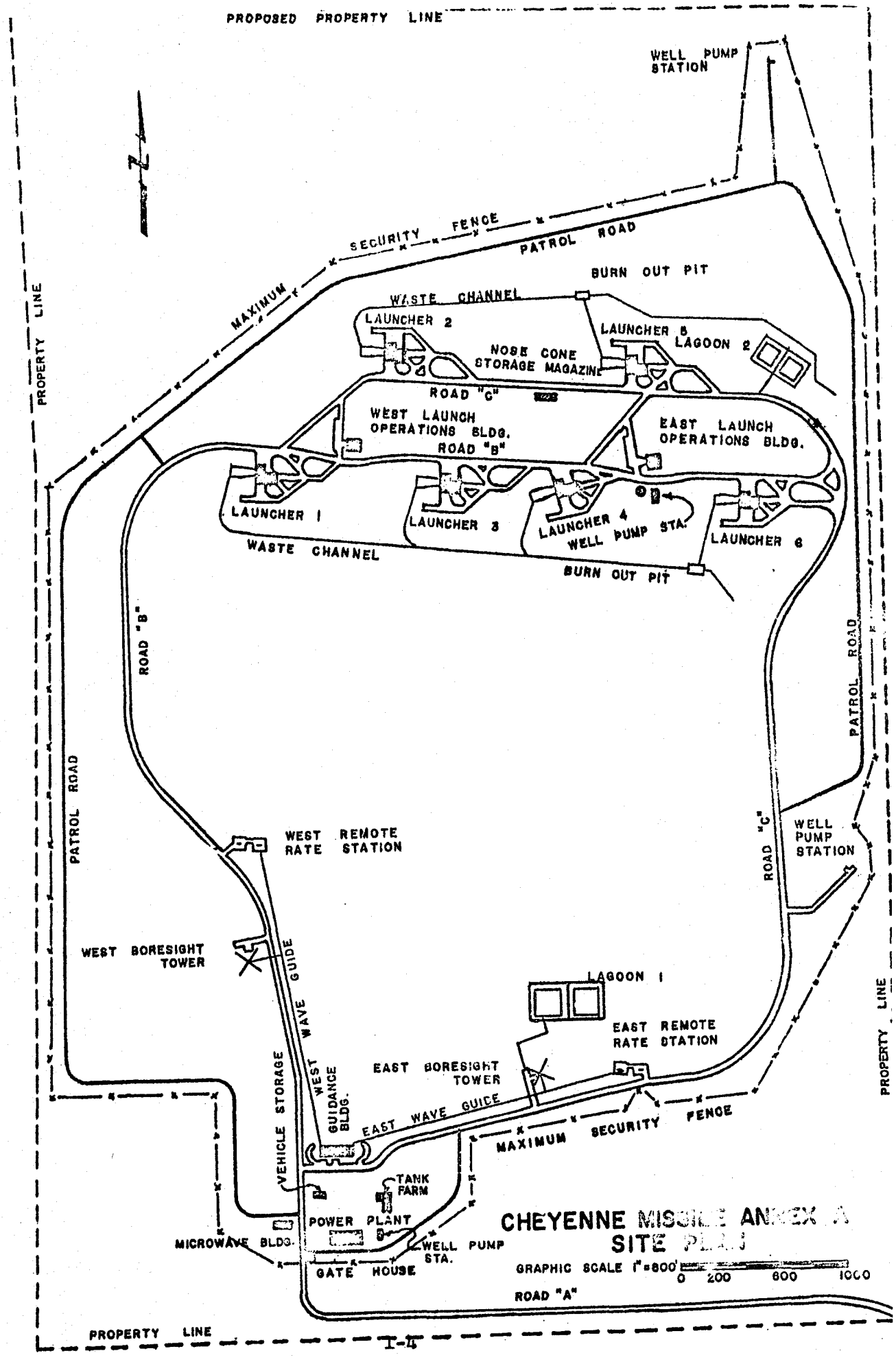
The missile facility construction was accomplished by the Corps of Engineers, United States Army, acting as the construction agency for the United States Air Force. Actual construction at the missile site was under the supervision of the Cheyenne Area Engineer, Omaha District, located at Francis E. Warren Air Force Base, Wyoming.

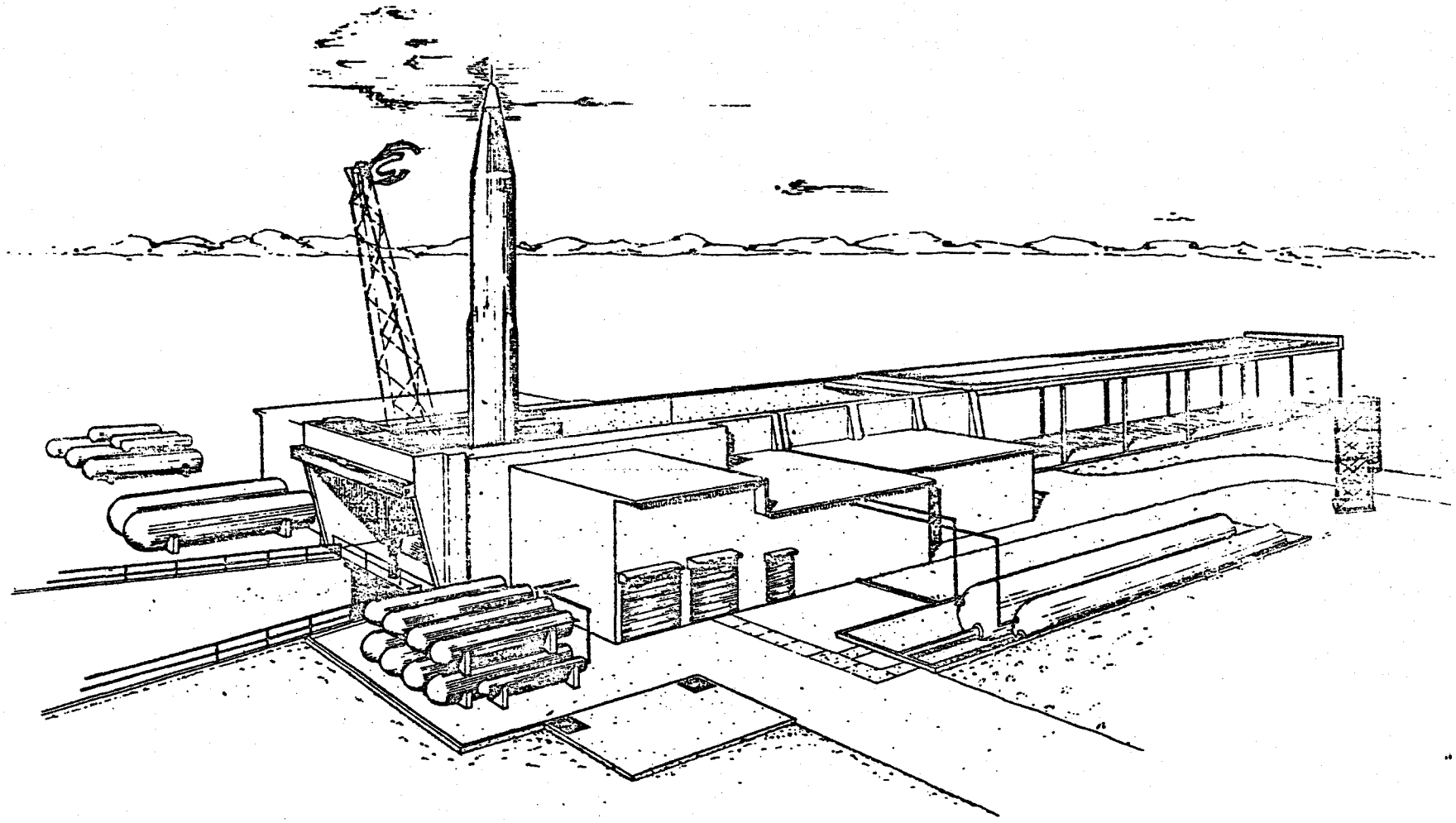
The Ballistic Missile Division (BMD), Air Research and Development Command, was the United States Air Force Agency responsible for providing the Atlas Weapons system to the Strategic Air Command for employment. This responsibility includes: Atlas missile development; providing construction plans for missile sites; surveillance of site construction; and installation and testing of missile hardware. An AFBMD fi ld office was established at Francis E. Warren Air Force Base.

The Squadron I Launch Facilities are of the soft (above ground) type built on a 1 x 6 concept with six launchers built at one site (identified as A on the site location map). The facilities include two missile complexes, each with three launchers, a launch operations building and a guidance facility. The guidance facilities for the two complexes are housed in one guidance building. Support facilities constructed at the site include: power, communication, and re-entry vehicle storage facilities.

The first construction contract for work under Squadron I was awarded on 23 April 1958 to J. H. Beckman Construction Co. for

construction of the Access Road to Site "A". The last contract for work on Squadron I was awarded on 30 August 1961 to W. G. Dale Electric Company for Installation of a Communication Duct to the Guided Missile Assembly Building. Final inspection was made and the work on the Communication Duct to the Missile Assembly Building was accepted on 17 May 1962. This constituted physical completion of all work under Squadron I. The total cost of the project was $28,314,022 and involved nineteen (19) construction contracts and one (1) supply contract. A tabulation of these contracts and a cost breakdown will be found in Section V.

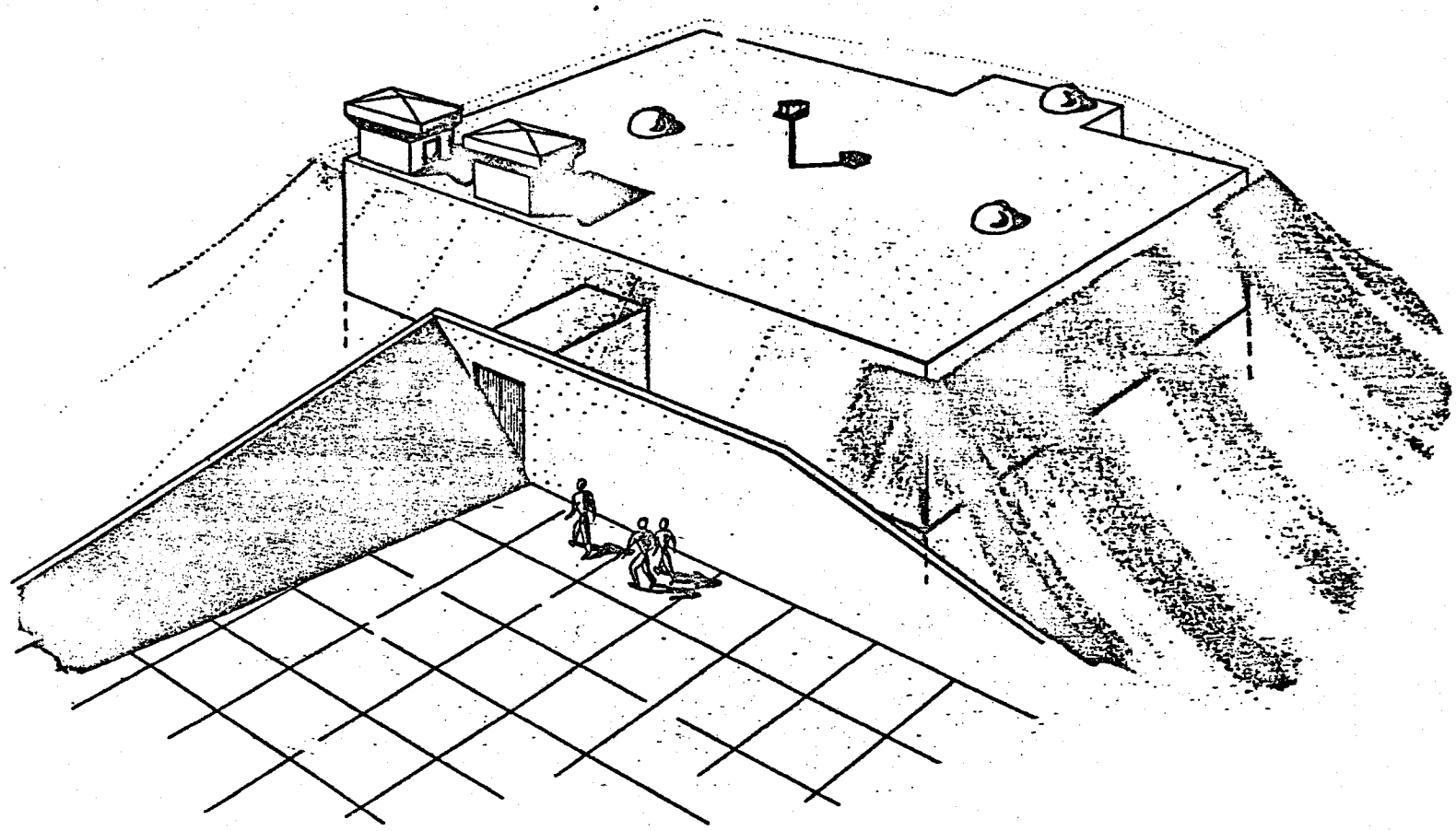

PROPOSED PROPERTY LINE
WELL PUMP STATION
SECURITY FENCE
PATROL ROAD
MAXIMUM
PROPERTY LINE
BURN OUT PIT
WASTE CHANNEL
LAUNCHER 2
LAUNCHER 5
LAGOON 2
NOSE CONE STORAGE MAGAZINE
ROAD "C"
WEST LAUNCH OPERATIONS BLDG.
ROAD "B"
EAST LAUNCH OPERATIONS BLDG.
LAUNCHER 1
LAUNCHER 3
LAUNCHER 4
WELL PUMP STA.
LAUNCHER 6
WASTE CHANNEL
BURN OUT PIT
ROAD "B"
PATROL ROAD
PATROL ROAD
ROAD "C"
WELL PUMP STATION
WEST REMOTE RATE STATION
WEST BORESIGHT TOWER
WEST WAVE GUIDE
LAGOON 1
EAST REMOTE RATE STATION
EAST BORESIGHT TOWER
WEST GUIDANCE BLDG.
EAST WAVE GUIDE
VEHICLE STORAGE
MAXIMUM SECURITY FENCE
TANK FARM
POWER PLANT
MICROWAVE BLDG.
WELL PUMP STA.
GATE HOUSE
ROAD "A"
PROPERTY LINE
PROPERTY LINE
CHEYENNE MISSILE ANNEX A
SITE PLAN
GRAPHIC SCALE 1"=800'
0 200 600 1000



PERSPECTIVE

ANNEX "A"

LAUNCH & SERVICE BUILDING



PERSPECTIVE

LAUNCH OPERATIONS BUILDING

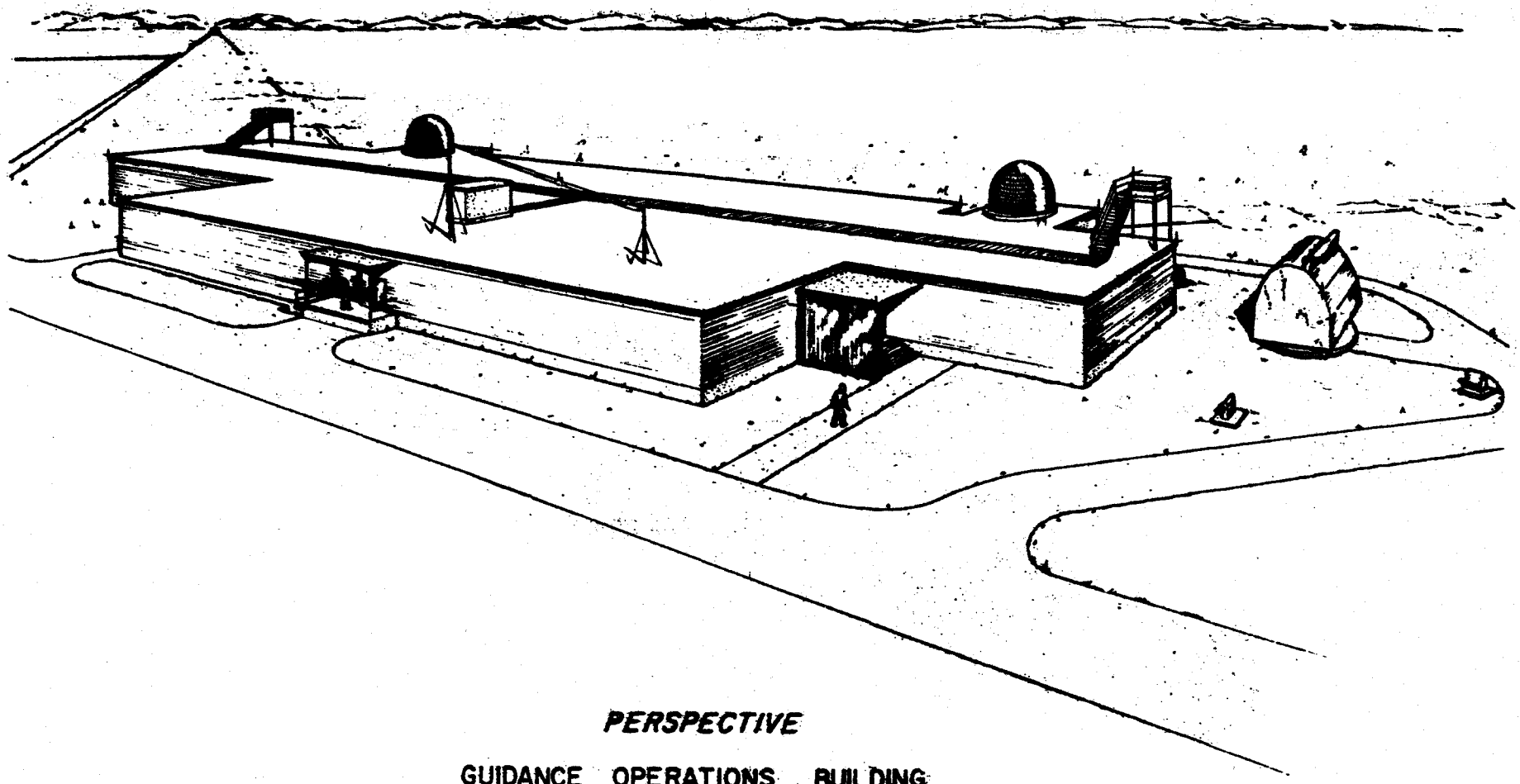
ANNEX "A"

LAUNCH FACILITIES

The Launch Facilities include six missile launch service buildings (each with one launcher), two launch operations buildings and the necessary roads and utilities, water, electric power generation and sewage.

The Launch & Service Buildings are 103 x 133 feet with reinforced concrete walls and floor. The service rooms have reinforced slab roofs and the missile bay has a mobile roof which may be moved to permit vertical positioning of the missile and firing.

The Launch Operations Buildings are two story buildings with earth mounded up to their roof lines. The outside dimensions are 73 x 78 feet and the entire structure is of reinforced concrete. The buildings contain entrance tunnels, blast proof doors and escape hatches. These buildings are comparable to the so-called block houses at test installations.



PERSPECTIVE

GUIDANCE OPERATIONS BUILDING

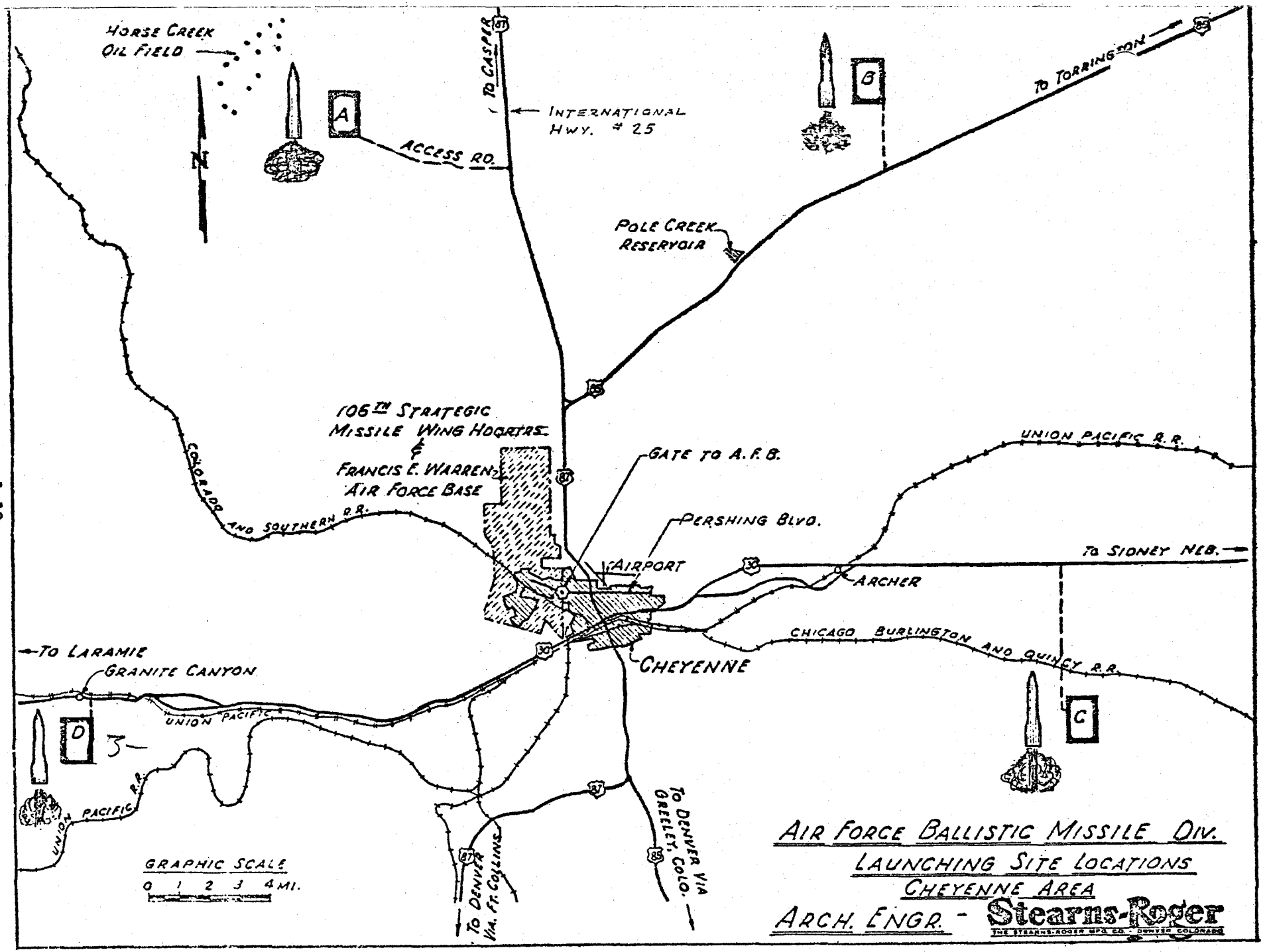
ANNEX "A"

GUIDANCE FACILITIES (ANNEX A)

Inflight guidance of the missiles is accomplished by the Guidance Facility.

The principal structure of the Guidance Facility is the Guidance Building. This is a one story structure, 75 x 212 feet, with full basement. The basement walls are of reinforced concrete and the remainder of the walls are reinforced concrete block. An interesting, though not particularly unusual feature of the building, is that all of the roof and a part of the floor are supported by pre-stressed concrete panels. The panels are up to about 36½ feet long and contain reinforcing wire prestressed up to 175,000 lbs/sq inch.

The Guidance Facility also includes two boresight towers and two remote rate stations located about 1300 feet east and north of the Guidance Building. They are connected to the building by waveguide inclosures.


HORSE CREEK OIL FIELD
A
ACCESS RD.
TO CASPER
INTERNATIONAL HWY. # 25
B
TO TORRINGTON
POLE CREEK RESERVOIR
106TH STRATEGIC MISSILE WING HDQRTRS. & FRANCIS E. WARREN AIR FORCE BASE
COLORADO AND SOUTHERN R.R.
GATE TO A.F.B.
UNION PACIFIC R.R.
PERSHING BLVD.
AIRPORT
TO SIDNEY NEB.
ARCHER
CHICAGO BURLINGTON AND QUINCY R.R.
CHEYENNE
TO LARAMIE
GRANITE CANYON
UNION PACIFIC
D
UNION PACIFIC R.R.
C
TO DENVER VIA GREELEY, COLO.
TO DENVER VIA FT. COLLINS
GRAPHIC SCALE
0 1 2 3 4 MI.
AIR FORCE BALLISTIC MISSILE DIV.
LAUNCHING SITE LOCATIONS
CHEYENNE AREA
ARCH. ENGR. - Stearns-Roger
THE STEARNS-ROGER MFG. CO. - DENVER COLORADO

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 sustained 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 its trajectory the two booster engines and associated equipment are jettisoned to reduce the load. The sustainer engine continues to accelerate the missile until a velocity of approximately 16,000 MPH is reached. The "vernier" rockets are then used to trim the velocity to the exact value required. After the vernier guidance is discontinued, the missile will follow a purely ballistic or unguided course to the target area.

As the vernier is shut down, the nose cone becomes disassociated from the rocket framework. The remaining framework is destroyed by aerodynamic heating.

The rocket control is accomplished by the guidance system which essentially employs radioinertial guidance through the early portion of the rocket's flight. This is basically a radio control system.

The missile structure consists of thin gauge stainless steel and the missile contains approximately 300,000 parts not including the ground support equipment.

DESIGNATION:	SM-65
PRIME CONTRACTOR:	CONVAIR, Ramo-Wooldridge
STATUS:	Development Production
RANGE:	6200 miles (approx.)
VELOCITY:	16,000 mph max.
FRAME:	
Stages:	(1½)
Manufacturer:	CONVAIR
Length (Overall), ft:	75 (approx.)
Diameter (Body), ft:	10
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

SECTION II

DESIGN - PLANNING

Launch Facilities and Utilities
Squadron I
F. E. Warren Air Force Base

1. The original schedule called for completion of the design by 15 May 1958 and construction in November 1959. In conference held in MRD on 14 March 1958, AFBMD furnished revised completion schedules ranging from 1 July 1959 to 1 October 1959 with structures complete by 1 September 1958. The schedule did not provide adequate review, correction, reproduction, advertising and award time.

2. Accordingly, it was the decision of the conference to review the project during reproduction and advertising period, issuing corrections by addendum.

3. Project documents for advertising were delivered in packages from 28 to 31 May 1958. Mandatory award date of 30 June 1958 was rescinded. Project advertised 9 June 1958 with bid opening scheduled 8 July 1958. Bid opening was delayed to 15 July because of numerous addenda revisions and particularly by necessary clarification of specifications added by Addendum to allow optional high pressure storage vessels in lieu of previously specified proprietary laminated vessels. A major change by addendum No. 1 allowed competitive bidding on all proprietary valves except 17 Minneapolis-Honeywell valves. Several of the valves furnished later proved unacceptable in system operation and had to be replaced.

4. In attempt to meet the 30 June 1958 award date and July to September 1959 completion date, the project was advertised without the propellant loading system skids, instrumentation, controls, expansion, anchorage and structural support, and the power facilities for the site.

5. The propellant loading system skids and yard piping were shown schematically on the plans but were drastically revised in the issued modifications.

6. The missing design for the propellant loading system was verbally promised by August 1958 and later scheduled for 1 September 1958. In a preliminary design concept review for Squadron II propellant loading system skids it was recognized by Air Force that design was still lacking for Squadron I, and plans were made for providing. Change Order Conference held 23 October 1958 established incremental dates for delivery of skids and structural supports packages from 1 November 1958 to 22 November 1958. All PLS Skids were received 22 December 1958 and structural supports received 27 January 1959.

7. The power facilities were awarded under separate contracts with the generators furnished under a supply contract and plant designed for the generators being procured. Final specifications for procurement of generators were received in Omaha District on 11 July 1958 but were so ambiguous and poorly written that they were not issued to bidders. Representatives of AFBMD, their design Architect-Engineer, LAD, and OD rewrote the specifications 21 to 23 July. Project was advertised 25 July and bids taken 21 August 1958.

8. Change Order Conference held 23 October gave final design and completion date of 15 January 1959 for power plant with design to be by different Architect-Engineer than had furnished design for generators. AFBMD gave requirement of 1 July 1959 for first generator on the line, which was considered by all conferees as an impracticable date. The date of 1 September was considered to be the earliest and 1 October a more realistic completion date. The completed design was received 19 February,

project advertised 21 February and bids opened 24 March, a slippage of 35 days in design schedule. A serious problem encountered in this project was coordination of generator switchgear included in the plant design with the prior procured generators. Omaha District had strongly recommended procurement of switchgear with the generators to provide compatible equipment.

9. The first modification to provide for rotating one launcher 15 degrees and deleting the television system was initiated prior to bid opening, was scheduled to Omaha District on 1 August 1958 and was received 12 August 1958.

10. Nitrogen recharging units for vaporizing liquid nitrogen and deliverying gaseous nitrogen up to 12,000 psi during testing of systems were to have been furnished by the Air Force. This procedure was against recommendations of OD and LAD to have contractor furnish the necessary units. When Air Force was requested to furnish the units for testing they were not available and had to be procured by OD on accelerated basis.

11. There have been a total of 117 modifications issued, the major portion attributed to changed or latent criteria. An interferring project provided for installation of waveguide enclosures performed under a separate contract and issued as a negotiated contract due to compressed schedules. This project entailed considerable excavation operations and installations across and under existing facilities and created coordination problems. The waveguide system was not completed and the requirement for the facility was deleted.

Guidance Facilities, Squadron I

1. The original schedule for this item called for completion of design in April 1958 and construction in November 1959. In conference held in MRD on 14 March 1958, AFBMD furnished revised schedule requiring completion by 15 May 1959 with design to be completed 15 April 1958 award desired by 1 June 1958 and mandatory by 30 June 1958. On BMD schedule a 2-week period was allotted for review, correction, reproduction and issuance of advertised document which was an unfeasible schedule. It was the decision of the conference that the project should be advertised to meet the target of 1 June 1958 award with review concurrent with reproduction and advertising.

2. Project documents for Guidance Facility were to have included all roads, grading and other utilities in the general guidance area but the submittal received on 20 April 1958 did not include these items which had to be included in a subsequent contract causing coordination problems during construction.

3. The project was advertised 25 April 1958, bids opened 27 May 1958 and award 2 June 1958. The project during the reproduction and advertising period required voluminous addenda corrections.

4. Numerous criteria changes injected too late for inclusion in addendum were issued in Modification No. 1 scheduled to Omaha on 14 June 1958 and received 21 June 1958. Changes included reduction of Computer Room area, relocation of Maintenance area, adding shielding in Computer Room and revising flexible floor.

5. Design for Guidance Building provided heat from a central heating plant. Though it was established in July 1958 that heating plant would not

be built, the change order conference to establish design schedule for a heating plant addition to the Guidance Facility was not held until 23 October 1958. The schedule furnished in that conference provided for completed design to Omaha District on 17 November 1958. The design modification was received on 20 December 1958.

6. There was a total of 35 modifications issued on the project.

Squadron Maint Bldg (For All Squadrons)
F. E. Warren AFB

Item	BMD Target Date to Omaha Dist	Actual
Orig Schedule	15 Aug 58	
BOD	15 Oct 59	
*Final Design	15 Feb 59	12 Mar 59
Bid Opening	21 Mar 59	15 Apr 59
Award	30 Mar 59	20 Apr 59
BOD	15 Oct 59	15 Feb 60 (Joint occupancy 16 Nov 59)

*Incomplete - process vessels omitted from final plans, requiring separate advertisement.

Following addenda were issued under the bid invitation:

Addendum No. 1 issued 3 April 1959 consisting of:

Specification revisions - 4
New drawing added - 1

Addendum No. 2 issued 6 April 1959 consisting of:

Specifications revisions - 95
Descriptive drawing revisions - 75
Reissued drawings - 17

Addendum No. 3 issued 9 April 1959 consisting of:

Specification revisions - 16
Descriptive drawing revisions - 13

Squad #1 - F. E. Warren AFB

Mods 20 and 22 - PLS Piping Supports and Skids (Originally promised to be issued by Aug 58)

Item	BMD Target Date to Omaha Dist	Actual
Design conf rev of in-progress	18 Sep 58	18 Sep 58
Change Order Conf		23 Oct 58
PLS Packages Schedule		
Control Equipment	23 Oct 58	23 Oct 58
Fuel piping skids	31 Oct 58	22 Dec 58
Liq Oxygen Piping & Skids	3 Nov 58	22 Dec 58
GN_2 & N_2 Piping and Skids	7 Nov 58	22 Dec 58
Helium Piping & Skids	12 Nov 58	22 Dec 58
Structural Supports	(10 days after each skid, with final on 22 Nov 58)	22 Dec 58

Guidance Facility
F. E. Warren AFB Squadron I
Schedule of Target Dates

Item	BMD Target Date	Actual
*Final Design	15 Apr 58	20 Apr 58
Bid opening	27 May 58	27 May 58
Award	1 Jun 58	2 Jun 58
BOD	** 15 May 59	1 May 59

*Design was not reviewed and did not include utilities which were to have been included. Review was concurrent with reproduction and advertising. Utilities were included with Launch Facilities and Utilities.

** Original schedule indicated Nov 59. May date established in Conf MRD on 14 Mar 58.

Mod #1 (Genl Rev)	14 Jun 58	21 Jun 58
Mod #2 (Rev flooring, ducts 7 wave guide sleepers)	14 Jul 58	
*Mod #15 (Change from central to Ind.htg plant)	17 Nov 58	20 Dec 58

*This mod initiated after much "prodding" from OD.

Following addenda were issued under the bid invitation:

Addendum No. 1 issued 15 May 58 consisting of:

Specification revisions - 174
Descriptive drawing revisions -452
Drawings reissued - 3
Drawings deleted - 4
Drawings added - 6

Addendum No. 2 issued 16 May 58 consisting of:

Specification revisions - 9
Drawings reissued - 1
Descriptive drawing revisions - 15

Addendum No. 3 issued 20 May 58 consisting of:

Specification revisions - 22
Descriptive drawings revisions - 21

Addendum No. 4 (Telegraphic) issued 22 May 58 consisting of:

Specification revisions - 1

Addendum No. 5 (Telegraphic) issued 23 May 1958 consisting of:

Descriptive drawing revisions - 1

Launch Facils & Utils, Squad I
F. E. Warren AFB

Item	BMD Target Date to Omaha Dist	Actual
*Final design	15 May 58	1 Jun 58
Bid opening	25 Jun 58	15 Jul 58
Award	1 Jul 58	22 Jul 58
** BOD		
Launch Ops Bldgs	1 Jul 59	
Launchers (2)	1 Jul 59	
Launchers (2)	2 Aug 59	
Launchers (2)	1 Sep 59	
Utils	1 Oct 59	
Water Stat	1 Jul 59	

*Incomplete and not reviewed. Review was concurrent with advertising. PLS instrumentation, controls, expansion, anchorage and structural supports not included in advertisement. (PLS skids shown schematically as was yard piping - but all were drastically revised by later modification.)

**BOD originally scheduled for Nov 59. BOD dates are those given in Missile conf MRD 14 Mar 58.

Following addenda were issued under the bid invitation:

Addendum No. 1 issued 23 Jun 58 consisted of:

Specifications revisions - 852
Descriptive drawings revisions - 1245
Drawings reissued - 54
Drawings deleted - 3
Drawings added - 1

Addendum No. 2 issued 27 Jun 58 consisted of:

Specification revisions - 57
Revisions to Add #1 - 17
Descriptive revisions to dwgs - 12

Addendum No. 3 issued 21 Jul 58 consisting of:

Bid opening delayed to 15 Jul 58.

Addendum No. 4 issued 3 Jul 58 consisting of:

Specification revisions - 56
Descriptive drawings revisions - 16

Addendum No. 5 (Telegraphic) issued 11 Jul 58 consisting of:

Specification revisions - 7

Power Plant - Squadron I
F. E. Warren AFB

Item	BMD Target Date to Omaha	Actual
Original design (To have been included with Utils, Sqd I)	15 May 58	
Final Design		
Generators	1 Jul 58	*11 Jul 58
Plant	15 Jan 59	17 Feb 59
Bid opening	(Per C.O.Conf 24 Oct 58)	
Generators	21 Aug 58	21 Aug 58
Plant	25 Feb 59	24 Mar 59
Award		
Generators	1 Aug 59	4 Aug 59
Plant	1 Mar 59	31 Mar 59
BOD		
Generator (Delivery)	1 Jun 59	
Plant (1st generator)	1 Oct 59	
Plant (Complete)	1 Dec 59	

*Specs had to be completely redrafted. Delayed advertising by 2 weeks.

Following addenda were issued under the bid invitation:

Addendum No. 1 issued 13 March 1959 consisting of:

Specification revisions - 64
Descriptive drawing revisions - 13

Addendum No. 2 issued 17 March 1959 consisting of:

Specification revisions - 12
Descriptive drawing revisions - 3

Nose Cone Facilities and
Tech Supply (Rehab)
F. E. Warren AFB

(District Design)

Directive received	14 Nov 58
Scheduled date for receipt of criteria	25 Nov 58
Actual date of receipt for all criteria	12 Mar 59
Advertised	30 Mar 59
Bids opened	28 Apr 59
BOD Scheduled	1 Sep 59
* BOD Rescheduled	30 Oct 59
Actual BOD	30 Oct 59

*BOD changed due to major change in criteria from AFBMD.

Following addenda were issued under the bid invitation:

Addendum No. 1 issued 9 April 1959 consisting of:

Specifications Revisions - 150
Descriptive drawings revisions - 65
Drawings reissued - 19
Drawings added - 1
Drawings deleted - 2

Addendum No. 2 issued 17 April 1959 consisting of:

Specifications revisions - 104
Descriptive drawings revisions - 126
Drawings reissued - 16
New drawings added - 1
Drawings deleted - 1

Addendum No. 3 (Telegraphic) issued 22 Apr 59 consisting of:

Descriptive drawings revisions - 9

Microwave Facility and
Communication Duct Facility
F. E. Warren AFB

(District Design)

Directive received	14 Nov 58
Scheduled date for receipt of Criteria	25 Nov 58
Actual date of receipt of all criteria	23 Jan 59
Design complete and bid advertised	2 Mar 59
Bids opened	2 Apr 59
BOD (Site A and Main Base)	30 Jun 59
* BOD (Sites B, C and D)	30 Jul 59

*Design and BOD delayed due to AFBMD resiting on Sites B, C and D on 28 Mar 59. Resiting accomplished by construction modification.

Following addenda were issued under the bid invitation:

Addendum No. 1 issued 19 Mar 59 consisting of:

Specification revisions - 152
Descriptive drawing revisions - 89
Drawings reissued - 3
Drawings deleted - 1

Addendum No. 2 issued 25 March consisting of:

Specification revisions - 4
Descriptive drawings revisions - 2

SECTION 3

CONSTRUCTION PERIOD

Article from Rocky Mountain Construction - 1 May 1958

Rocketing from a low bid of $185,417.00 to a high of $489,820.00 with the engineers estimate split in at $361,556.00, fifteen bidders helped get the "show on the road" by quoting on the very first project advertised for bids for the $65 million U. S. Air Force's Intercontinental Ballistic Missile Installation, to be built on sites approximately 20 miles northwest and northeast of Ft. Francis E. Warren.

Bids for this first construction project, which calls for 5.04 miles of access road to auxiliary Site A, were received in the office of the Area Engineer of the Corps of Engineers, F. E. Warren AFB, Cheyenne, on April 17, and the J. H. Beckman Construction Co., Sioux Falls, S. D., was low bidder at $185,417. Formal contract for this work was awarded to the Beckman firm by the Omaha Office of the Corps of Engineers, at the quoted price on 23 April 1958. Knisley-Moore Co., Douglas, Wyoming, was second bidder on this project at $216,168 and the third bidder was the Siegrist Construction Co., Denver, Colorado at $248,717.64.

Second in what will be a long series of all types of construction projects, was bid on April 23. This project is an access road to auxiliary Site B, and Peter Kiewit Sons Co., Denver, Colorado submitted the low bid of $227.609. Knisley-Moore Co. again came in second, with a bid of $235,339, and the third bidder was W. E. Barling of Meeteetse,

Wyoming, at $245,837.60. Engineers estimate for this section of work was $262,190.

Upcoming for early bidding are the first buildings involved in the development of this huge installation. The Corps of Engineers has just announced that plans are slated for release in late April, with bids to close about 27 May, for Guidance Facilities for Squadron I. This work will include a one-story 60 X 200 ft. concrete and concrete block structure with prestressed roof and floor, completely air conditioned; a one story 19 X 14 ft. reinforced concrete and concrete block remote rate station building; and transformer station calling for the construction of 4,000 lineal feet of wave guide trench and installation of two towers and pedestals.

As the opening of bids for this first contract signaled the official beginning of this gigantic project, the Defense Department announced two additions to its planned ring of tactical launching bases for intercontinental ballistics missiles - one at Offutt AFB, Omaha, Nebraska and one at Spokane, Fairchild AFB, Spokane, Washington, each to cost $25 million.

Warren AFB, the first tactical missile launching base to be built, will remain the largest such installation in the country. Vandenberg AFB in California, where the men who man the Cheyenne Base will be trained, is the fourth base with ability to fire a missile over the top of the world.

The big volume of work proposed for the Cheyenne missile sites will start breaking in June of this year, when, according to Colonel D. G. Hammond, District Engineer of the Corps of Engineers, $16 million

worth of projects will be awarded through the regular competitive channels of the construction industry.

Initial building projects, some already slated for bidding around May 27, will include guidance buildings, launching facilities and heating and power plants for both sites.

Individual estimates of construction quantities involved in this work have not yet been finalized, but the Army Engineers say that approximately 75,000 cubic yards of concrete will be placed by early 1960 and an additional 25,000 yards by the latter part of the same year.

SECTION 3

WINTER CONCRETE PLACEMENT COMPLETES ICBM BASE ON TIME

Article in Contractors & Engineers Magazine - October 1959

Winds up to 75 mph, temperatures down to 28 degrees below zero, and more than 60 inches of snowfall were some of the problems that plagued a contractor on a high priority missile base. But George A. Fuller Co., Los Angeles, worked through the rugged Wyoming winter to build the first squadron launching facilities for Atlas Intercontinental Ballistic Missiles near Francis E. Warren Air Force Base, Cheyenne.

Located on a high plateau - some 7,000 feet above sea level - 23 miles northwest of Cheyenne, the site is exposed to the full brunt of the winter storms that sweep out of the northwest. Occasional storms would have been bad enough, but at this high location the wind seems to blow at gale force every day, and temperatures range between 10 and 25 degrees even on the good winter days. The $12 million contract for the six launchers, plus support facilities and utilities, was scheduled for completion in 390 calendar days. There was no alternative but to carry on the work through the winter at the maximum speed. Actually there were very few days during the entire winter when concrete was not being placed, and other work was also in progress on those days.

Construction at this site includes the complete launching and service facilities for one SAC missile squadron. Living quarters for the men are provided at Warren AFB in Cheyenne. The launching facilities include six launch and service buildings (from which the

missiles are launched), two launch operations buildings (the block houses) a water pumping station, waste-water channels, several miles of road in the project area, water and electrical distribution systems, and a sewerage system. Guidance Facilities are being built under a separate contract. All of this work is being done under the direction of the Omaha District of the U. S. Army Corps of Engineers.

The largest structures in Fuller's contract are the reinforced-concrete launch and service building, which measure roughly 104 X 133 feet. They extend about two stories above ground, with footings and flame deflectors penetrating well below ground. A 120 X 26 ft. steel trestle extends out from one end of the launcher to carry a mobile roof fitted with snow melting panels. This roof covers the missile when it is lying flat in the storage position. It rolls back onto the trestle when the missile is to be raised to the firing position.

The two-story operations builidngs have heavily reinforced roofs and are back-filled to roof level with an earth fill on 3 to 1 slopes all around. The launching crews are in these builidngs at the time missiles are fired. Getting the work under way late in August, Fuller and the earthwork subcontractor, Bramley Construction Co., Denver, concentrated their efforts on the excavations for the structures and the work on the roads and underground utilities. The building excavations were substantially completed before extreme cold or frozen ground became a handicap, and enough of the roads had been built to provide access to the work areas.

Knowing that concrete placement must continue throughout the winter, the contractor made suitable provisions to fight the cold. Work, carried on simultaneously on three of the launchers, was protected with inclosures of plywood, canvas, and visqueen clear plastic film.

While the basic reinforced concrete frame of each launcher was being built, almost the entire structure was enclosed in a housing. Then, after the concrete had been placed and cured, portions of the enclosures were removed and reused on other structures. Openings in the concrete walls were then closed with temporary doors or with covering of Visqueen so that work could continue inside.

The exterior walls of the enclosures were generally built of 1/4 inch plywood sheets backed with 2 X 4 frames around the edges. These were quickly and easily assembled and could be stacked on top of each other for the high enclosures. The roofs of the protective housing were usually of canvas or Visqueen 2 X 4 frames. Where the roof was to be removed for concrete placement, canvas was used. Where light was desired inside the enclosures the frames were covered with 6-mil clear Visqueen plastic sheets. This material kept out the wind and snow, held in the heat and admitted enough daylight so that the men could work without artificial light.

The frequent gusty winds that reached near-hurricane velocities frequently damaged the canvas and Visqueen covering. These high winds made it necessary to tie down the enclosures on the inside and guy them down from the outside.

Heat inside the enclosures was provided by steam boilers and unit heaters, and by Master oil-burning heaters. Two Bryan 30 h.p. stationary steam boilers were set up in temporary buildings conveniently located between the launchers. The steam was piped to each launcher site and to the operations building where unit heaters were installed in the areas to be heated.

Additional heat for areas where it was not practical to bring the steam was supplied by 30 Master oil-burning heaters. Twenty of these were Model 125 with 100,000 Btu ratings. The other ten were the larger Moder 600, rated 500,000 Btu.

Inside the warm enclosures, workmen erected the wall forms using Symons Steel-Ply form panels. Beam bottoms and slabs were formed with plywood and lumber and shored with Symons steel and wood adjustable shores. Each of the launchers required 80,000 sq. ft. of forming, and each operations building called for an additional 30,000 square feet.

Fuller had a total of 74,000 square feet of the Symons form panels on the job, and they were kept in constant use. In erecting some of the high wall and beam forms, the crews worked from Adjustomatic scaffolding which also provided temporary support for the forms. When the shoring and bracing were in place, the scaffolding was removed and reused in other areas.

The 28,000 cubic yards of concrete for the project was produced on the site under a subcontract by Western Concrete, Inc., Denver. Western set up a Noble Mobile semi-automatic batch plant to dry batch the cement and aggregates to a fleet of five 7-yard Jaeger transit mixers carried on Mack trucks.

Water for the mix was heated to 135 degrees by a steam boiler, but the dry ingredients were not heated. The lower areas of the plant were enclosued to protect the workmen and prevent loss of fines to the high winds. The conveyor taking the batches from the weight bucket to the transit mixers was closily covered for the same reason.

Aggregates were delivered by truck and stockpiled at the plant. A Michigan 125A tractor shovel fed the sand and gravel to a hopper, and a belt carried them to the plant bins. Cement was received by truck transport and elevated directly into the plant storage silo.

Two Lorain 35 ton Moto-Cranes each using two 1-yard Gar-Bro buckets, took the concrete from the transit mixers and hoisted it to the forms. The workmen opened the canvas roof covers just enough to permit concrete to be placed and vibrated. Then the covers were replaced, and a temperature of at least 50°F was maintained inside the enclosure for a 7-day curing period. Exposed surfaces were sprayed with Hunt Process curing compound.

Although most of the necessary earthwork was done in the fall with spreads of C and D Tournapulls, there was some excavation and a considerable amount of backfilling to be done during the winter. Where frost had to be ripped, Bramley used a Caterpillar D8 equipped with dozer and ripper. Excavation around the building was handled by a Gradall.

Placing and compacting backfill was one of the most troublesome winter jobs. Material without frost chunks was brought in by the D Tournapulls or by trucks and spread by Allis-Chalmers HD-5 tractor dozers. Open areas were then compacted by Tampo and Vibro-Plus

vibrating rollers towed by HD-5 tractors. Areas close to the walls or that could not be reached by rollers were tamped by gasoline powered Wacker tampers.

The backfilling of utility trenches presented similar problems. Here the contractor used an International TD-14 Dratt Skid shovel to place shallow lifts of unfrozen material in the trenches. Compaction was accomplished with the use of a small one man Essick vibrating roller.

A crew of about 300 men worked through the winter to keep the project on schedule. As weather became more favorable in the spring, the crew was augmented until it reached 600 men. Completion is scheduled for this month.

The supervisory staff for George A. Fuller Co. is headed by project manager Frank McGarvey, project superintendent Ed J. Marn, project engineer Carl Wilcox, and assistant superintendent James Shaw. Area superintendents in charge of separate structures were Charles E. Rayner, Fred Strauss, John E. Moore, and Gene Anstey.

Supervision of the project for the Omaha District of the Corps of Engineers is handled through the Cheyenne Area Office under Area Engineer Colonel S. T. Martin and Assistant Area Engineer Joe Patterson. The Resident Engineer on the project is Ray Fauss who is assited by Maurice Garber and Bill Bieg.

Colonel D. G. Hammond is District Engineer of the Omaha District. Plans and specifications for the project were prepared by Holmes and Narver Inc., Los Angeles

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. De Fraia, 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 problem 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 refining processes; procedure and systems analysis; and city, regional, and national economic studies for government organizations both in this country and abroad.

SECTION 4

HISTORY OF PRIME CONSTRUCTION-NEWSPAPER ARTICLES

F. E. WARREN AFB

WYOMING STATE TRIBUNE - AUGUST 24, 1958 - PACIFISTS LEAVE JAIL VICINITY UPON ADVICE FROM SHERIFF. What had been billed as a "public information project" in front of the Laramie county jail, at the corner of Pioneer and 19th this morning, was moved from that location by the group which has been opposing construction of a missile-launching site north of here.

Some six persons, headed by Robert Pickus, took up signs they said explained why Ellanor Calkins and the Rev. Theodore Olson were in the jail and marched away from the south side of 19th to a location on 18th street between Carey and Capitol.

Sheriff N. E. Tuck had ordered no visiting privileges for all prisoners in the jail after the announcement that the demonstration would be held outside.

Pickus told newsmen in front of the jail at noon today that "the sheriff and a deputy sheriff told us they had denied all visiting privileges to everybody. They said they had turned away about 15 persons who came to see prisoners this morning. They told us any demonstration in front of the jail tends to create a riot situation inside the jail. This seemed unreasonable to us, but trusting the sheriff's statement we agreed to move our public information project several blocks from the jail."

Pickus said, "It appears to us that denying prisoners the right to be visited by their wives, fathers and mothers is far more likely to cause a riot than having six people in front of the jail a short time."

After some discussion, the group shouldered several signs and marched toward the spot where they said they would hold the project.

Pickus said they would continue the project every day next week at the same location between the hours of noon and 1:30 p.m. and between 4 and 6 p.m.

One sign read, "Why are Ellanor and Ted in jail?" There were signs which the group said answered the question. One read, "They believe we are losing the struggle with totalitarianism because we have been dominated by faith in violence."

Another read, "They want you to protest missiles as a hopeless and immoral policy." A third said, "They aren't Communists."

Mrs. Calkins and Olson are held in jail in lieu of payment of fines of $100 each levied against them last Wednesday in justice court on charges of trespassing.

Kenneth Calkins, 23, Chicago, is recovering at Memorial hospital from a pelvic injury he suffered when he was struck by a truck at the gate to the missile site construction last Tuesday.

A press release handed out by the group said, "We wish they weren't in prison, but we know they are willing to accept their punishment hoping it will help their message reach you."

Pickus said he believed the public had been made aware only of the "harassment" demonstration by his group at the missile site when it attempted to block traffic.

SEPTEMBER 30, 1959 - FIRST ATLAS MISSILE IS ENROUTE FOR CHEYENNE. SAN DIEGO, Calif. (UPI)-An Atlas intercontinental ballistics missile was enroute on what may be the slowest trip of its career today - a six-day haul by truck to Warren Air Force Base near Cheyenne, Wyo.

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 enroute 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.

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.

OCTOBER 2, 1959 - ATLAS MISSILE IS HARMLESS IN TRANSPORT. The first Atlas missile for Francis E. Warren Air Force Base is an expensive piece of equipment but harmless as an empty pop bottle.

The missile, due to arrive in Cheyenne some time this afternoon is being transported without fuel or warhead.

Essentially, the 75-foot Atlas will be a tube of thin steel equipped with empty rocket motors when it rolls through the streets of Cheyenne.

The steel walls of the Atlas are so thin that the structure is filled with a harmless gas at a low pressure - less than in the tires of a car - to help maintain its shape.

When the Atlas is fueled, a mixture of liquid oxygen and RP-1, a kerosene-like hydrocarbon; take the place of this gas.

Liquid oxygen, which is not shipped in the convoys which bring the Atlas, but separately, by tank car, poses the greatest danger in launching the Atlas.

The chemical, which in large masses, assumes a very pale, steely blue color, must be handled with great care by specially trained personnel.

OCTOBER 2, 1959 - GE DEPARTMENT IN CHARGE OF MISSILE RE-ENTRY UNIT. The organization responsible for the development of the re-entry vehicle used on the Atlas missiles at Warren Air Force base, is the Missile and Space Vehicle department (M&SVD) of General Electric, Robert

Jordan is the base manager for the local office.

In June, 1955, M&SVD, Philadephia, Pa., began work under contracts for development of re-entry vehicles (nose cones) for the Atlas ICBM and the Thor ICBM. Both Thor and early operational Atlas used basically the same nose cone.

Under extensions of these contracts, GE is continuing development of advanced type re-entry vehicles. One of these advanced types will be installed on Atlas missiles at Warren AFB.

The re-entry vehicle, an independent system in itself, is the forward-most part of the ballistic missile. Its purpose is to house, protect and transport a payload during both missile flight and re-entry.

The rocket booster thrusts the re-entry vehicle at a prescribed velocity along a desired path.

At a predetermined point the rocket engines shut off and the re-entry vehicle separates from the missile body to continue a ballistic trajectory through space at speeds of 15,000 miles per hour or more. The apogee, or highest point of this flight, is measured in the hundreds of miles. Actual re-entry into the earth's atmosphere is the prime test of the vehicle. At this point it must withstand destructive forces never before encountered by an airborne system. The temperature of the air at the front end of the vehicle rises to 10,000 degrees F. which is hotter than the surface of the sun.

When a space vehicle is slowed up by re-entry into the earth's atmosphere the shock is equivalent to a car slamming into a solid brick wall at 60 mph.

Missile nose cones are subjected to the same battering forces that work on meteors, but while meteors burn out or break up, nose

cones must remain intact and functional.

This is the job of the Missile and Space Development department of General Electric.

The liaison engineer at the Warren Field office is Elsworth Gerrels. The field representative is Ned Branine.

WYOMING STATE TRIBUNE - NOVEMBER 10, 1959 - THIRD ATLAS ARRIVES BY C-133 AIRLIFT. The third Atlas missile and the second to be airlifted to this Strategic Air Command base near Cheyenne arrived this morning.

The new intercontinental ballistics missile arrived aboard a mammoth C-133, specially modified to carry the multi-ton rocket.

All three missile are for testing of the launching mechanism and missile-handling equipment and none will be test fired.

The first Atlas was delivered by truck several weeks ago. The first missile was flown in last Tuesday. All three came from Miramar Air Station, San Diego, California.

The purpose of the airlifts was to demonstrate delivery capability for the Atlas by air and to carry out logistic studies in connection with the missiles.

Air Force officials noted that the arrival of the missiles does not mean that Warren has reached operational status.

Fifteen launching pads at four sites ringing Cheyenne are under construction and bids will be opened Nov. 24 on nine other launching pads which will be dispersed as much as 60 miles from the city.

WYOMING STATE TRIBUNE - APRIL 14, 1960 - ATLAS REPORTED OPERATIONAL AT WARREN LAUNCHING PADS. Operational status - ability to fire on target - has been achieved at a Warren air base Atlas ICBM complex,

Newsweek Magazine said today.

The report is contained in a one-paragraph item headlined "Pentagon Pipeline."

Newsweek said, in the issue dated April 18: "Nothing has been said about it, but some Atlas ICBM's already are operational at Warren Air Force base near Cheyenne. Three Atlas squadrons eventually will be installed at Warren the second base-- Vandenberg AFB was the first -- from which ICBM's could be fired in case of attack."

Sources at the base had no comment on the magazine statement.

The Warren ICBM complex includes 13 multiple and separate launching facilities located over a large area in southeastern Wyoming, northern Colorado and western Nebraska. The project altogether involves 24 Atlas launching pads.

The magazine apparently referred to Site A, approximately 20 miles northwest of Cheyenne. This is the largest of all the planned facilities, featuring six launchers.

The Air Force recently released photographs showing three Atlas missiles "in place" at Site A.

In a briefing at Warren last month, AF officers revealed that Site A was to be operational by May 15. That would be before President Eisenhower leaves for Europe to participate in the June Summit conference.

Construction of Site A was started in mid-summer of 1958.

WYOMING STATE TRIBUNE - APRIL 18, 1961 - THEY'RE READY NIGHT AND DAY AT CHEYENNE BASE. On a windy mesa north of here, range country desolate as great parts of the world will be if the "birds" ever start flying, sprawls one of America's operational missile sites.

Inside thick concrete huts the gleaming stainless steel Atlas missiles rest on their sides, the nuclear warheads screwed in place.

If your security clearance is sufficient - and if you have the desire - you can reach up and pat the warhead. It is far more potent than the bomb which killed 78,000 at Hiroshima.

A couple hundred yards away, in another concrete bunker, an Air Force captain and a lieutenant, pistols strapped to their waists, sit behind panels where the pressing of a grey "start" button can send these monsters on a half-hour, 6,000-mile trip into enemy territory.

At this base they are ready, day and night, to start shooting from six pads.

If war with Soviet Russia ever comes and that button is pressed, the handful of soldiers at Warren Air Force Missile Squadron No. 1 will not know what targets they shot at.

And they probably would never find out if they hit. For this lonely outpost would be a prime target of Communist rockets.

It is a fearsome duty. The missilemen have, as their sole professional reason for being, a job they hope to God they never have to do.

The deadly seriousness of a "missile gap" strikes home after a visit to this base.

A year ago it was still in construction.

The only intercontinental ballistics missiles in operational readiness were three Atlas rockets standing in vulnerable exposure in gantries along the Pacific at Vandenberg Air Force Base in California.

Khrushchev passed them less than a quarter-mile distant in his train trip up the West Coast in 1959. He may have been amused, because his Soviet Union had far more.

What Russia did not have was the enormous nuclear bomber force of the Strategic Air Command. And not having such a force, Russia had pushed with tremendous emphasis on missiles until the peril to America became evident to even the most dense.

Since that time, just a year ago, U.S. missile sites have begun to sprout across the entire western half of the continent.

Besides the six pads at this base, there are nine at Warren II now operational. Nine more were turned over to SAC less than three weeks ago around Omaha. There are at least three new Atlas pads at Vandenberg.

So today the United States has at least 30 operational missile launching pads where a year ago it had three.

But this is only the tiniest beginning. The Air Force is building a missile network so staggering in size and cost that it dwarfs any previous military crash program in history.

All but one of the 14 Atlas complexes will be west of the Mississip They will be in California, Wyoming, Nebraska, Washington, Kansas, Oklahoma, Texas, New Mexico and New York.

They must be widely dispersed. One single complex nearing completion embraces in area bigger than Connecticut.

SECTION V

CONTRACTS

ATLAS "D"

F.E. WARREN - SQUADRON I

1. Basic Contracts.

a. Squadron I, F.E. Warren Missile Base, was constructed under the FY 58 program. It consisted of 20 contracts. These contracts were awarded during the period 23 April 1958 through 30 August 1961. The initial contract was for construction of the Access Raod to Site "A". As a result of the piece-meal award of the work by numerous contracts, the amount of the original program does not reflect the dollar value at any one given time, but represents the dollar value of all contracts at time of their award plus the Government costs for each individual contract at the time of award. The main launcher contract was awarded on 22 July 1958 in the approximate amount of $11,762,000.

b. There were no assigned Service contracts awarded for Squadron I.

c. The Procurement contract for Squadron I consisted of the purchase of Diesel Engine Generator Sets. This contract was awarded 4 September 1958 in the approximate amount of $1,438,000.

d. The Support contracts were awarded during the period of 23 April 1958 through 30 August 1961 for an amount of $4,249,000.

e. The sum of these contracts amount to $17,449,000. Estimated Government costs of $1,367,000, a contingency allowance of $3,196,000, and $138,000 for land result in an original cost estimate of $22,150,000.

2. Increases:

a. Additional costs have been incurred as follows: (They relate generally to 11 classifications).

(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) Sub-allotments
(10) Contingencies.
(11) Government-furnished equipment.

b. Approximately $2,406,000 was for definitizing facility design. This work consisted of adding the PLS skids to the main launcher contract by modification. Design was not complete at time of award of the basic contract.

c. Criteria changes amounted to $1,623,000. These changes included relocation of launch buildings, deletion of TV antennas, revisions to process control equipment, revisions to flame deflectors, and revisions to foundations.

d. Modifications for correction of interference consisted of revisions to water supply lines and relocation of power lines in the amount of $5,000.

e. Modifications, for the purpose of this report, listed as field changes consisted of overruns of estimated contract quantities. These overruns amounted to $73,000.

f. Modifications to the procurement and support contracts were varied in nature and amounted to $608,000.

g. Claims, exclusive of acceleration, amounted to $332,000. A major portion of these claims were for compaction of backfill and adjustment in price for overruns in base course.

h. Acceleration costs added approximately $3,809,000. These costs were incurred as a result of directing the contractor to work additional personnel, shifts, and equipment in lieu of granting excusable time extensions. This action was necessary to meet the established need dates.

i. Government costs were increased by $96,000 due to increased scope of construction.

j. Sub-allotments in the amount of $89,000 were issued to various Agencies and Districts for performance of support work. The major item was to the Bureau of Reclamation in the amount of $77,000 for construct of a power line for the Liquid Oxygen facilities.

k. The contingency reserves under this Squadron are approximately $3,000.

l. Government-furnished equipment consists of Nitrogen Rechargers furnished by the Government for use by the contractor for testing PLS equipment. The cost of these rechargers was $334,000. A credit of $18,000 was reflected in this account for a diesel engine generator which was transferred to Vandenberg AFB.

m. Summary:

(1)	Original program, less contingency:		$18,954,000
(2)	Increases:		
	(a)	Design definitization	$2,406,000
	(b)	Criteria changes	1,623,000
	(c)	Interference changes	5,000
	(d)	Field changes	73,000
	(e)	Mods. to Proc. and Support Contracts	608,000

(f)	Claims	332,000	
(g)	Acceleration	3,809,000	
(h)	Government costs	96,000	
(i)	Sub-allotments	89,000	
(j)	Contingencies	3,000	
(k)	Government-furnished Equip.	316,000	
(3)	Subtotal		9,360,000
(4)	Revised construction program		$28,314,000

Following is a cost summary as of 30 April 1962 which represents essentially final costs under Squadron I.

FOR OFFICIAL USE ONLY

JUSTIFICATION SUMMARY SHEET
($000,000)

MISSILE BASE F. E. WARREN MB - SQUAD I AS OF 30 April 1962

Item	Original CCE	(1) CCE at Last Programming	(2) Current CCE	(2) - (1) Change
1. Basic Constr. Cost	$ 17.5	$ 17.9	$ 17.9	$ 0.0
2. Land	0.1	0.1	0.1	0.0
3. Utility Connections	0.0	0.0	0.0	0.0
4. Mods (Neg.)	0.0	6.2	6.2	0.0
5. Changes Issued	0.0	0.0	0.0	0.0
6. Claims Settled	0.0	2.6	2.6	0.0
7. Claims Validated (Unsettled)	0.0	0.1	0.0	- 0.1
8. Unawarded Work	0.0	0.0	0.0	0.0
9. Contingencies	3.2	0.0	0.0	0.0
10. Gov't. Cost	1.4	1.5	1.5	0.0
TOTAL CCE	$ 22.2	$ 28.4	$ 28.3	$ - 0.1
Potential Claims	0.0	0.0	0.0	0.0

1 Atch
Spread Sheet

FOR OFFICIAL USE ONLY

ESTIMATED ULTIMATE COST

F. E. WARREN MISSILE BASE
SQUAD I

As of 30 April 1962

1. Funding vs Total P321 Requirement

Total P321 Requirement	$ 28,314,022.16
Funding	$ 28,331,022.16 *
Balance	$ 17,000.00

2. Allotments vs Obligations

Allotments Received	$ 28,074,288.00 (Form AF 378)*
Obligations Incurred	$ 28,251,343.52
Unobligated Allotments	$ 79,678.64 **
Commitments	$ 28,251,343.52
Uncommitted Balance	$ 79,678.64 **

3. Funding vs Ultimate

Estimate Ultimate Cost	$ 28,314,022.16
Funding	$ 28,331,022.16
Balance	$ 17,000.00

* Permission granted by BSLF-23-2-12 and 11-5-8 to increase authorization to $28,331,022.16

** Based on TWX authorization above.

FORECAST OF FUND REQUIREMENTS

BASE: WARREN MB SQUAD I

REPORT AS OF 30 Apr 62

	CCE	OBLIGATIONS	COMMITTMENTS NOT OBLIGATED	UNCOMMITTED	FORECAST OF ADDITIONAL FUNDS REQUIRED		
CONSTRUCTION COST LAND	17,930,673.93 139,963.00	17,906,743.89 139,963.00		23,930.04			
MODS NEGOTIATED	6,178,257.37	6,178,257.37					
CHANGES ISSUED							
CLAIMS SETTLED	2,586,463.00	2,561,463.00		25,000.00			
CLAIMS VALIDATED							
UNAWARDED WORK							
CONTINGENCIES	3,175.61			3,175.61			
GOVERNMENT COST (30 Apr 62)	1,475,489.25	1,464,916.26		10,572.99			
TOTAL	28,314,022.16	28,251,343.52		62,678.64 plus sta bal. of 17,000.00			

TOTAL FUNDS AVAILABLE $28,331,022.16 per BSLF 23-2-12 and 11-5-8

~~IF A DIFFERENCE EXISTS~~

ATLAS D

F. E. WARREN MB, SQUAD I

INDEX

ATLAS D

F. E. WARREN MB - SQUAD I

BASIC CONSTRUCTION COSTS

Construction Contracts	$ 16,011,624
Assigned Service Contracts	0
Procurement Contract	1,438,192
Government Furnished Materials	316,435
Overruns and Underruns	76,220
Suballotments, etc.	88,203
Surveys	0
Total	$ 17,930,674

TAB 1

ATLAS D

F.E. WARREN MB - SQUAD I

BASIC CONSTRUCTION COSTS

a. Construction Contracts

4876	Access Road, Site A	$ 185,417
4910	Access Road, Site B	227,609
4957	Guidance Facil., Squad I	648,990
5064	Launch Facil. & Util., Com 65/3-4	11,762,420
5538	Elec Power (Power Plant)	532,450
5566	Squad Maint Bldg.	1,091,046
5580	Access Road	193,817
5604	Nose Cone Facil.	311,294
5727	Process Vessels	136,375
5743	Gatehouse & Vehicle Storage	11,254
5764	Wave Guide Enclosure	233,900
6218	Inert Stg. Bldg. & Rehab. Tech Supply	21,294
6270	Squad. Maint. Bldg.- PME Lab	98,823
6332	Squad. Maint. Bldg. Changes	133,000
6377	Process Gas Facil. Changes, Warren I	97,000
6380	Warren I & II Facil. Changes	6,828
6381	Warren I & II Facil. & Util. Changes	150,472
6852	Warren I, II, III & FY 59 Facil. Changes	157,560
7147	Comm. Duct, G/M Assy Bldg.	12,075

b. Assigned Service Contracts - Negative

c. Procurement

5119	Diesel Engine Generators	$1,438,192.00

d. Government-Furnished Materials

Nitrogen Rechargers	$ 334,905.56
Fairbanks-Morse Diesel Eng Generator transferred to Vandenburg AFB	-18,471.00

e. Overruns and Underruns $ 76,220.73

f. Suballotments

Miscellaneous Items	$ 88,203.53

g. Surveys - Negative

Land

Tab 2a
ATLAS D
F. E. WARREN MB, SQUAD I

LAND

899008	Land Fee Purchase	$ 83,407
899009	Land Ease Restr	30,983
899010	Land Ease R/O/W	25,573
		$139,963

Utility Connections

TAB 3a
ATLAS D
F.E.WARREN MB - SQUAD. I

UTILITY CONNECTIONS

Negative

Mods (Negotiated) Excluding Modifications Covering Claims

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

MODS (NEGOTIATED) EXCLUDING MODIFICATIONS COVERING CLAIMS

RECAPITULATION

Modifications Negotiated (Over $100,000)

Contract DA-5064

Mod. 1	$ 127,433	
Mod. 19	147,923	
Mod. 20	2,406,307	
Mod. 21	137,734	
Mod. 22	136,000	
Mod. 26	313,401	
Mod. 112	1,554,883	
		$ 4,823,681

Modifications Negotiated (Under $100,000) 1,354,576

Total $ 6,178,257

TAB 4a
ATLAS D
F. E. WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng- 5064

Modification No. 1

1. Source COC 25
2. Date 30 Jun 58
3. Received by Contracting Officer 1 Aug 58
4. Presented to Contractor 15 Aug 58
5. Negotiation Completed 19 Jan 59
6. Notice to Proceed 22 Sep 58
7. Cost Estimates

   COC No. 25

   Amount $ --

   Initial Government Estimate $ 127,698

   Source Omaha District

   Initial Proposal $ 435,946

   Date 24 Oct 58
8. Negotiated Amount $127,433
9. Remarks - Relocate Launch Buildings, delete TV towers, and miscellaneous electrical revisions.

TAB 4a
ATLAS D
F. E. WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng- 5064

Modification No. 19

1. Source COC 3 (W-1)
2. Date 23 Oct 58
3. Received by Contracting Officer 31 Oct 58
4. Presented to Contractor 3 Nov 58
5. Negotiation Completed 10 Mar 59
6. Notice to Proceed 19 Dec 58
7. Cost Estimates

   COC No. 3 (W-1)

   Amount $ 169,800

   Initial Government Estimate $ 147,923

   Source Omaha District

   Initial Proposal $ 158,256

   Date 8 Dec 58
8. Negotiated Amount $147,923
9. Remarks: Revisions to process control equipment.

TAB 4a
ATLAS D
F.E.WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng-5064

Modification No. 20

1.	Source	COC 8 (W-1)
2.	Date	23 Oct 58
3.	Received by Contracting Officer	5 Dec 58
4.	Presented to Contractor	8 Dec 58
5.	Negotiation Completed	9 Dec 60
6.	Notice to Proceed	31 Dec 58
7.	Cost Estimates	
	COC No. 3 (W-1)	
	Amount	$ 160,000
	Initial Government Estimate	$ 707,932
	Source	Omaha District
	Initial Proposal	$5,200,000
	Date	30 Jan 59
8.	Negotiated Amount	$2,406,307
9.	Remarks:	Revise Propellant Loading System

15

TAB 4a
ATLAS D
F. E. WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng- 5064

Modification No. 21

1. Source COC CC-WAR-5
2. Date 17 Nov 58
3. Received by Contracting Officer 3 Dec 58
4. Presented to Contractor 23 Dec 58
5. Negotiation Completed 10 Mar 59
6. Notice to Proceed 11 Mar 59
7. Cost Estimates

   COC No. CC-WAR-5

   Amount $ 180,000

   Initial Government Estimate $ 137,811

   Source Omaha District

   Initial Proposal $ 138,430

   Date 30 Jan 59
8. Negotiated Amount $137,734
9. Remarks : REVISE FLARE DEFLECTORS

TAB 4a
ATLAS D
F. E. WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng- 5064

Modification No. 22

1. Source AFBMD (WDIC) Ltr
2. Date 10 Oct 58
3. Received by Contracting Officer 14 Oct 58
4. Presented to Contractor 30 Oct 58
5. Negotiation Completed 20 Jan 59
6. Notice to Proceed 8 Jan 59
7. Cost Estimates

   COC No. LADE

   Amount $ 96,400

   Initial Government Estimate $ 136,181

   Source Omaha District

   Initial Proposal $ 427,427

   Date 2 Jan 59
8. Negotiated Amount $ 136,000
9. Remarks : Add expansion joints.

TAB 4a
ATLAS D
F. E. WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng- 5064

Modification No. 26

1. Source COC 3 (W-1)
2. Date 23 Oct 58
3. Received by Contracting Officer 27 Jan 59
4. Presented to Contractor 27 Jan 59
5. Negotiation Completed 28 Jan 60
6. Notice to Proceed 12 Mar 59
7. Cost Estimates

   COC No. 3 (W-1)

   Amount $ 28,000

   Initial Government Estimate $ 315,307

   Source Omaha District

   Initial Proposal $ 343,628

   Date 23 Feb 59
8. Negotiated Amount $ 313,401
9. Remarks : **Revise foundations.**

TAB 4a
ATLAS D
F. E. WARREN MB, SQUAD I

Negotiated Modification

Contract No. DA-25-066-eng-5064

Modification No. 112

1. Source -- N/A
2. Date -- N/A
3. Received by Contracting Officer -- N/A
4. Presented to Contractor -- N/A
5. Negotiation Completed Unilateral
6. Notice to Proceed -- N/A
7. Cost Estimates
   - COC No. -- N/A
   - Amount $ -- N/A
   - Initial Government Estimate $573,000
   - Source Omaha District
   - Initial Proposal $ -- $2,345,311
   - Date --
8. Negotiated Amount -- $1,554,883
9. Remarks - Acceleration to hold Air Force required need dates

TAB 4b
ATLAS D
F. E. WARREN MB, SQUAD I
MODIFICATIONS NEGOTIATED (UNDER $100,000)

Contract	No.	Amount
DA-4876	3	$ 291
4910	3	592
4957	34	55,539
5064	103	769,330
5119	5	23,013
5538	19	109,192
5566	25	121,275
5580	5	23,483
5604	9	87,899
5727	0	0
5743	1	1,034
5764	13	39,445
6218	1	292
6270	8	53,838
6332	6	22,604
6377	6	3,734
6380	2	611
6381	10	21,212
6467	4	14,839
6852	2	6,354
7147	0	0
	259	$1,354,576

Changes Issued But Not Negotiated (Pending)

TYPE C

ATLAS D

F. E. WARREN MB, SQUAD I

CATALOG LISTED BUT NOT NEGOTIATED

Negative

Claims (Settled)

TAB 6
ATLAS D
F. E. WARREN MB, SQUAD I

CLAIMS SETTLED

RECAPITULATION

Claims Settled (Over $100,000)

Contract DA-5064

Mod 118	$ 232,300	
Mod 119	200,424	
Mod 120	125,000	
Mod 121	1,743,500	
Contract DA-4957		
Mod 35	$ 253,089	
		$ 2,554,313
Claims Settled (Under $100,000)		32,150
	Total	$ 2,586,463

TAB 6a
ATLAS D

F. E. WARREN MB - SQUAD I

CLAIMS VALIDATED
(UNSETTLED) OVER $100,000

1. Contract No. DA-25-066-eng-4957
2. Contractor: Doolittle Construction
3. Modification No. 35
4. Source: Contractor
5. Date: 1 December 1960
6. Received by Contracting Officer: 1 December 1960
7. Negotiations Completed: 8 February 1962
8. Contractor's Value of Claim: $465,692.13
9. Settlement Cost: $253,089
10. Description: Acceleration

TAB 6a
ATLAS D
F. E. WARREN MB, SQUAD I

Claims (Settled)
(Over $100,000)

1. Contract No. DA-25-066-eng-5064
2. Contractor George A. Fuller
3. Modification No. 118
4. Source Contractor
5. Date --
6. Received by Contracting Officer --
7. Negotiations Completed February 1961
8. Contractor's Value of Claim $264,264
9. Settlement Cost $232,300
10. Description Acceleration costs

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

Claims (Settled)

(Over $100,000)

1. Contract No. DA-25-066-eng-5064
2. Contractor: George A. Fuller
3. Modification No. 119
4. Source: Contractor
5. Date: --
6. Received by Contracting Officer: --
7. Negotiations Completed: February 1961
8. Contractor's Value of Claim: $270,161
9. Settlement Cost: $200,424
10. Description: Backfill compaction

26

TAB 6a
ATLAS D
F. E. WARREN MB, SQUAD I

Claims (Settled)
(Over $100,000)

1. Contract No. DA-25-066-eng-5064
2. Contractor George A. Fuller
3. Modification No. 120
4. Source Contractor
5. Date --
6. Received by Contracting Officer --
7. Negotiations Completed --- February 1961
8. Contractor's Value of Claim $144,661
9. Settlement Cost $125,000
10. Description Base course overruns

TAB 6a
ATLAS D

F. E. WARREN MB - SQUAD. I

CLAIMS (SETTLED)
OVER $100,000

1. Contract No. DA-25-066-eng-5064
2. Contractor: George A. Fuller
3. Modification No. 121
4. Source: Contractor
5. Date: 22 March 1961
6. Received by Contracting Officer: 23 March 1961
7. Negotiations - Completed
8. Contractor's Value of Claim: $ 2,710,143
9. Government Estimate $ 1,743,500
10. Description: Acceleration and impact costs.

TAB 6b
ATLAS D
F. E. WARREN MB, SQUAD I

CLAIMS SETTLED (UNDER $100,000)

Contract DA-5064		
Mod 107	Emergency Shower Enclosures	$7,150
Contract DA-5566		
Mod. 26	Acceleration	25,000
	Total	$ 32,150

Claims Validated (Unsettled)

30

TAB 7
ATLAS D

F. E. WARREN MB - SQUAD I

CLAIMS VALIDATED (UNSETTLED)

Negative

UNAWARDED WORK

TAB 8

ATLAS D

F. E. WARREN MB - SQUAD I

UNAWARDED WORK

Negative

Contingencies

TAB 9a

ATLAS D

F. E. WARREN MB - SQUAD I

CONTINGENCIES

Two line items are still financially active. Contingencies in the approximate amount of $3,175.61 are being retained to cover additional costs in connection with the financial close-out of these items.

Government Costs

TAB 10a
ATLAS D

F. E. WARREN MB - SQUAD I

GOVERNMENT COSTS

Government costs as of 30 April 1962 are $1,463,291. This office has budgeted $10,573 for remaining Government costs. This amount represents the estimated cost to be incurred in financial close-out of the program, including preparation of reports. In order to preclude an additional reprogramming action on this Squadron, it is recommended that these funds remain in the FY 58 program until financial close-out.

Potential Claims

Negative

SECTION 6

ORGANIZATION AND PERSONNEL

CORPS OF ENGINEERS PERSONNEL

Colonel Sidney T. Martin, C.E., who 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 has 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 this assignement, 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, US Army Corps of Engineers Office, Cheyenne Area. Patterson was born at Tacoma, Wash. He was assigned as assistant to Area Engineer, Cheyenne Area, since May 1958. In this 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 included 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 12 May 1919 at Tutwiler, Miss., attended high school at Isola, Miss., and graduated from Mississippi 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 Manhatten District, CE. He 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 He supervised 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 24 July 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 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 administration functions in connection with the construction of the multi-million dollar inter-continental ballistic missile sites in 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.

On the following pages is a listing of the modifications on all contracts. For a description of these modifications exceeding $100,000. See Section V, "Contracts".

MODIFICATION SUMMARY
F. E. WARREN SQDN I
DA-5064, LAUNCH FAC. & UTIL.

NO.	DESCRIPTION	SOURCE
1.	Relocate launch bldgs; delete TV towers; misc elec revisions	AF
2.	Revise valve pit	CE
3.	Revise M/H T3 and power duct BD	CE
4.	Install $2\frac{1}{2}$" tel conduit under Road "B"	AF
5.	Delete Gatehouse	AF
6.	Clarify mechanical specifications	CE
7.	Ground security fence	CE
8.	Permit cold application of damp proofing	CE
9.	Grounding pads, Launchers 1, 3 and 6	CE
10.	Rev guard rail around waste disposal channel	CE
11.	Rev completion schedule, Road "C"	AF
12.	Cancelled	
13.	Install cable gutters & rev M/H specs	CE
14.	Change size of manholes on vessels	AF
15.	Revise flexible floor in LOB	AF
16.	Revise grading & LOX stg & catch tank accessories	AF
17.	Revise water stops; relocate security fence, elec. distr.	AF
18.	Revise vacuum pump down lines; filter assem.; LOX stg and N_2-HE heat exchangers	AF
19.	Add specs for process control equip	AF
20.	Furnish & install PLS skids	AF
21.	Add flame bucket deflector	AF
22.	Expansion joint tank calib rev specs	AF

23.	Revise joint filler specs	AF
24.	Delete tank saddles; Rev testing of exp. joints	AF
25.	Revise pipe joists & taping	AF
26.	Add equip pedestals; valve skid supports; PLS pipe hangars & rev LOX tank footings	AF
27.	Thimble eyes for dead-end connections	CE
28.	Lower water supply line	AF
29.	Delete security fence	AF
30.	Fireproof high voltage cables	AF
31.	Revise LOX stg tank sub-cooler	AF
32.	Misc electric & mechanical revisions	AF
33.	Substitute cold tar enamel for hot applied	CE
34.	Provide add'l appurtenances for vessel manholes	AF
35.	Provide sleeve for LOX facil tank emergency vent	AF
36.	Revise hole numbering; Insulate exterior portion, fuel stg tanks	AF
37.	Rev electrical conductors, circuit breakers & transformers	AF
38.	Rev fuel oil system, wiring & circuits	CE
39.	Construct found. for compressor No. 1 & rev control circuit for Door D-20	CE
40.	Provide optional pickling process	AF
41.	Provide elec heating cable for emerg showers	AF
42.	Add'l openings in concrete, relocate fuel stub-up, rev number & loc. of anchor bolts	AF
43.	Relocate power line "B"	CE
44.	Misc mech, elec & structural revisions	AF
45.	Revise coils & connec. to LOX sub-cooler	AF

46.	Revise accoustical tile specs; reloc disconnect switch in LOX tfr rm, provide for roll door	CE
47.	Provide stabilized parking area for special trailer equip	AF
48.	Revise PLS testing procedures, Site A	CE
49.	Delete lights from mobile roof, rev voltage & add conductors for Unit #13	AF
50.	Add 12" sleeve in roofs of L&S Bldgs, add'l conduit in L&S Bldg. #5	AF
51.	Revise floor drainage in L&S Bldgs	CE
52.	Insert numerical identification of L&S Bldgs.	CE
53.	Cover mezzanine opening; revise electrical panel, add duct work	AF
54.	Revise cables, conductors & conduit between L&S & Launch Opns Bldgs	AF
55.	Rev foundations for Skids 9 and 10	AF
56.	Provide temporary electrical power, Site "A"	AF
57.	Clarify specs re black & stainless steel piping	CE
58.	Relocate oxygen analyzer; air water tank; trichlor & lichlor fill & vent line	AF
59.	Delete stub-up piping in tunnel roof opening	AF
60.	Delete monorail & hoist	AF
61.	Change painting schedule	AF
62.	Time extension	CE
63.	Increase constr joint intervals to 65'	CE
64.	Misc. electrical changes	AF
65.	Provide elec chgs for air-conditioning glass doors and vent dampers	AF
66.	Revise mobile roof circuitry & other elec. chgs	AF
67.	Revise joints & footings	AF

68.	Relocate erection track studs & other misc elec	AF
69.	Replace 6 wire rope tandem drums	CE
70.	Orient valves in LOX, N_2, HE & fuel systems	AF
71.	Inst add'l conduit for East Launch Opns Bldg	CE
72.	Provide pipe sleeves & chg valve L-9	AF
73.	Provide clearance for 2" HW & HWR lines in tunnel	CE
74.	Revise flexible floor in Launch Control Room	AF
75.	Revise painting specs & sec. fence & lighting	CE
76.	Provide grout packets & revise stairs	AF
77.	Revise testing rqmts for cryogenic vessels	AF
78.	Procure duplicate instruments	AF
79.	Relocate cooling duct and Firex lines; add mobile roof limit switch	AF
80.	Revise valves H-47, H-48, S-67 & pressure gauge P1-111-5	AF
81.	Cancelled	
82.	Delete lichlor flushing line	AF
83.	Add'l test rqmts for helium system	AF
84.	Delete 3" umbilical cable & prov disconnect switch	AF
85.	Constr boiler room add'n, pump sta. No. 4	AF
86.	Revise valve installation & spt framing, Skid #7	CE
87.	Add diagonal brace & idler sheaves	AF
88.	Grout pump bases & rev N_2 transfer valve	AF
89.	Rev painting specs	CE
90.	Provide add'l removable section in LOX transfer room	AF
91.	Provide 8 personnel gates	CE
92.	Furnish 2 helium pumps	AF

93.	Change conduit size at L&S Bldg. No. 5	CE
94.	Fill fuel & diesel tanks with oil	AF
95.	Add 2" conduit road crossing & J-4 M/H	AF
96.	Delete Firex line "F"	AF
97.	Relocate water lines, Rms 100,101 & 102	CE
98.	Insert missing unit prices for 12" & 36" CMP	CE
99.	Revise PLS piping supports	AF
100.	Re-orient flanges of fuel stub-ups	AF
101.	Delete installation & sealing of duct covers	AF
102.	Re-align foundations for Skids 2-B	CE
103.	Perform final testing of mobile roof & rev circuits	AF
104.	Raise lighting fixtures in Rm 200, Lnchrs 1 & 3	CE
105.	Revise aggregate for gunite	AF
106.	Cancelled	
107.	Emergency shower enclosures	CE
108.	Revise circuits & limit switches; add cable guides	AF
109.	Contractor to retain paint made surplus by Mod 61	CE
110.	Rental agreement for warehouse space	CE
111.	Payment for thermo couples	AF
112.	Acceleration Costs	CE
113.	Install type "B" supports on Line "G"	CE
114.	Sub copper for stainless steel in LOX sub-cooler	CE
115.	Change motor starters from size 1 to 2	CE
116.	Provide super-elevation at curve P1-A2, Rd "A"	AF
117.	Replace cable between manholes A3 and A4	CE

118.	Acceleration costs, cryogenic vessels	CE
119.	Add'l compaction for backfill	CE
120.	Payment for overrun in stab. aggregate base course	CE

Net Increase (Incls $70,415 for O/runs) $7,971,799

DA-4876, Access Road

MOD NO.	DESCRIPTION	SOURCE
1.	Relocate field entrance	AF
2.	Drawing changes	AF
3.	Install gates	AF
4.	Time extension	CE

Total Value of Mods (Incls (-) $469 for U/runs) . . (-) $178

DA-4910, Access Road

1.	Relocate guards	AF
2.	Relocate fence	AF
3.	Remove unsuitable material	CE

Total Value of Mods (Incls (-) $16,191 for O/runs) (-) $15,599

MODIFICATION SUMMARY
F. E. WARREN - SQDN I
DA-4957, Guidance Facility

NO.	DESCRIPTION	SOURCE
1.	Add shielded wall; rev flexible floor & elec	AF
2.	Permit use of contractor's access road by other contractor	CE
3.	Revise cooling pad, lower sidewalk elev pit; delete loading platform screens	CE
4.	Provide pitched insulated roof on tracking antenna connection tunnels	CE
5.	Concrete slab under east & west waveguides	AF
6.	Furnish mounting plates	CE
7.	Increase size of conduit	CE
8.	Delete painting boresight towers	CE
9.	Maintain temporary access road	CE
10.	Increase size of RE Field Ofc Bldg., Site "A"	CE
11.	Rev flex floor; elec circuit changes; and collimater	AF
12.	Inc size of butt engines	CE
13.	Inc size of condenser water tank & pad	AF
14.	Sub insulating fiberboard	CE
15.	Provide separate heating plant, Guid Opns Bldg	CE
16.	Conduit for P/A System	AF
17.	Provide heat exchanger pads, equip, spt beam	AF
18.	Install fused disconnect switches	CE
19.	Re-arrange electrical panels	CE
20.	Misc elec changes	AF
21.	Cancelled	
22.	Delete elec door lock on computer room	AF

23.	Add mirror lites	AF
24.	Provide frames opening cable tray and conductor for equip trailer	AF
25.	Sighting post for boresight tower	AF
26.	Furnish and install volume dampers	CE
27.	Inc. door width	CE
28.	Misc elec changes	AF
29.	Misc elec chgs in computer room	AF
30.	Rev finish sched, mech equip room	AF
31.	Additional grounding	AF
32.	Relocate elevator pump unit	AF
33.	Chg floor opening and alter cable shroud	AF
34.	Time extension	CE
35.	Acceleration	
	Net Increase $308,628	

DA-5119, Diesel Engine Generators

MOD NO.	DESCRIPTION	SOURCE
1.	Delete foundation anchor bolts	AF
2.	Revise delivery schedule	AF
3.	Revise type fuel and air comp reg	AF
4.	Time Extension	AF
5.	Prepare 4th generator for overseas shipment	AF
	Total Value of Mods (Incls $1,268 for O/runs) . . . $30,281	

MODIFICATION SUMMARY
F. E. WARREN SQDN. I
DA-5538, Elec Power Plant

NO.	DESCRIPTION	SOURCE
1	Revise east coordinate for exist. MHA-1 & provide project sign	AF
2	Cancelled	
3	Provide sleeves for anchor bolts, generator foundations	CE
4	Provide inverted-type pothead for poles 2E and 3E to facilitate connections to equip.	AF
5	Cancelled	
6	Delete surplus equipment	AF
7	Revise telephone cabinets	AF
8	Cancelled	
9	Provide for use of EMBECO in grout mixtures	CE
10	Chg vents, fittings and add relay	AF
11	Obstruction light on boresight tower	AF
12	Cancelled	
13	Remove temporary power line, Site A	CE
14	Stiffen air plenum chamber	CE
15	Add rust inhibitor to Diesel cooling system	AF
16	Revise completion sched for seeding & mulching	CE
17	Misc piping changes	CE
18	Fill dead storage area with #2 Diesel fuel	CE
19	Increase the size of lube oil pump motors	CE
20	Acceleration	CE
21	Production loss due to changed conditions	CE
22	Assembly of Gov't Furn. equipment	CE
23	Furnish engineering services	CE

Net Increase $109 191

MODIFICATION SUMMARY
F. E. WARREN - SQDN I
DA-5566, Sqdn. Mtce Bldg

NO.	DESCRIPTION	SOURCE
1.	Revise transformer ratings	AF
2.	Revise fence & project signs	AF
3.	Revise lighting in paint booth	AF
4.	Revise structural steel bracing	CE
5.	Lower existing gas main	CE
6.	Misc elec mech & struct chgs	AF
7.	Provide parking area & rev piping at tank farm; add filter in pod cooling system	AF
8.	Cancelled	
9.	Misc elec & plumbing chgs	AF
10.	Misc mech, elec & struct chgs	AF
11.	Alternate source of bar joists	CE
12.	Black asphaltic spray coat paint in lieu of red lead brush paint	CE
13.	Install cable trays in Area "A"; chg size & location tel cabinets "A" & "E"	AF
14.	Permit use of bldgs S-1111, 1112, 1300	CE
15.	Substitute A-7 struct steel	CE
16.	Revise tank farm slab & add vessel foundations	AF
17.	Constr of helium unloading fac & power line	AF
18.	Chg Rooms 108, 109, 110 & misc elec chgs	AF
19.	Relocate duct & rev gate travelways	CE
20.	Relocate 75 KVA transformer	AF
21.	Inst conduit & conductors for elec doorlock on Door 17	CE
22.	Delete painting, check out stands & Rms 101, 102 & 103	AF

23.	Add 4' x 4' x 4" cabinet in lieu of E-400 cabinet	CE
24.	Payment for painting structural steel	CE
25.	Add power poles	AF
26.	Acceleration	
	Net Increase (Incls $128 for O/runs) $146,403	

DA-5580, Access Road

MOD NO.	DESCRIPTION	SOURCE
1.	Revise project sign	AF
2.	Repair road	AF
3.	Delete poles, down-guys, anchors; and add insulators and conductors	CE
4.	Remove flared end section, constr drop inlet, and backfill	AF
5.	Road repair, Site "B"	AF
	Net Increase (Incls $15,363 for O/runs) $38,846	

DA-5604, Nose Cone Facil (See Sqdn II)

MOD NO.	DESCRIPTION	SOURCE
1.	Applicable to Squadron II only	
2.	Prov wiring changes to gate house	AF
3.	Provide additional building and cubicle (See Sqdn II)	AF
4.	Applicable to Squadron II only	
5.	Floor Topping	AF
6.	Add flood lights	AF
7.	Change security grills	AF
8.	Cancelled	
9.	Applicable to Squadron II only	

10.	Applicable to Squadron II only	
11.	Install pole and transformer	AF
12.	Applicable to Squadron II only	
13.	Intrusion alarm system	AF
14.	Applicable to Squadron II only	
15.	Add receptacles	AF
16.	Applicable to Squadron II only	
17.	Applicable to Squadron II only	
18.	Occupancy agreement (no work involved)	AF
19.	Applicable to Squadron II only	
20.	Applicable to Squadron II only	
21.	Relocate water heater	AF
22.	Applicable to Squadron II only	
23.	Applicable to Squadron II only	
24.	Cancelled	
25.	Applicable to Squadron II only	
	Total Value of Mods (Incls (-) $292 for U/runs) . . .	$87,607

DA-5727, Process Vessels

MOD NO.	DESCRIPTION	SOURCE
1.	Time Extension, resulting from Nation-wide steel strike	CE
	Net Increase	No Change

MODIFICATION SUMMARY
F. E. WARREN SQDN I
DA-5743, Elec Power Plant (See Sqdn II)

MOD NO.	DESCRIPTION	SOURCE
1.	Applicable to Squadron II only	
2.	Revise telephone and speaker locations plus adding 2" c.o. road crossing	AF
	Net Increase $1,034	

DA-5764, Wave Guide Enclosure

MOD NO.	DESCRIPTION	SOURCE
1.	Correct interference between existing facil and wave guide work	AF
2.	Chg interior dimensions of concrete pit	AF
3.	Add'l changes to Wave Guide Enclosure	AF
4.	Rev wave guides to avoid conflict with existing utilities	AF
5.	Delete roof openings on Wave Guide Enclosures above Elev 113.01	AF
6.	Correct conflict between Wave Guide and existing facil	CE
7.	Replace concrete dip on patrol road	CE
8.	Reroute utils to avoid conflict with Wave Guide Duct	CE
9.	Modify Wave Guide Enclosures under precast concrete	CE
10.	Add'l corrections to conflicts - Wave Guides	CE
11.	Reroute and repair conduit and ground wire	CE
12.	Provide backfilling of Wave Guide trenches and salvage of pipe	AF
13.	Provide added backfill over Wave Guide Enclosures from Guidance Building	AF
	Net Increase $39,445	

MODIFICATION SUMMARY
F.E. WARREN - SQDN I

DA-6218, Inert Stg Bldg and Rehab Tech Sply

MOD NO.	DESCRIPTION	SOURCE
1.	Revise Doorholder	AF
	Total Value of Mod $292	

DA-6270, Squad Maint Bldg

MOD NO.	DESCRIPTION	SOURCE
1.	Revise air conditioning	AF
2.	Air conditioning changes	AF
3.	Extend fire alarm system	AF
4.	Relocate breakers	AF
5.	Cancelled	
6.	Misc electrical revisions	AF
7.	Time extension	
8.	Painting and electrical revision	AF
9.	Insulate air unit casing	AF
10.	Credit for valves	AF
11.	Auth repr of C.O.	CE
	Total Value of Mod $53,838	

DA-6332, Const Sqdn Mtce Bldg Chgs

MOD NO.	DESCRIPTION	SOURCE
1.	General revisions to contract plans and specs	AF
2.	Revisions to Struc, Mech and Elec Installations	CE
3.	Provide new Switchgear Section and Chg Elevation of Expansion Tank	CE

4.	Provide and install flex piping connections, lightning protection, etc.	CE
5.	Design def - provide and install controls for AC Units 12 and 14	AF
6.	Revise condenser water system and controls	CE
	Net Increase $22,604	

DA-6377, Process Gas Facil Chgs

MOD NO.	DESCRIPTION	SOURCE
1.	Provide and install pipe support	AF
2.	Cancelled	
3.	Locking devices for filters	AF
4.	Relocate vacuum pumps	AF
5.	Time extension	
6.	Relocate Line 140	AF
7.	Auth rep of Contracting Officer	CE
	Total Value of Mods $3,734	

DA-6380, Facil Chgs (See Squadron II)

MOD NO.	DESCRIPTION	SOURCE
1.	Engine foundation revisions (See Squadron II)	AF
2.	Applicable to Squadron II only	
3.	Applicable to Squadron II only	
4.	Change engine control switches	AF
	Total Value of Mods $611	

MODIFICATION SUMMARY
F.E. WARREN - SQUDN I
DA-6381, Facil Chgs (See Squadron II)

MOD NO.	DESCRIPTION	SOURCE
1.	Multipath sensing	AF
2.	Applicable to Squadron II only	
3.	Applicable to Squadron II only	
4.	Addition of fire alarm "J" boxes	AF
5.	Relocate switches from control panel	AF
6.	Applicable to Squadron II only	
7.	Time Extension	CE
8.	DC power source (See Squadron II)	AF
9.	Terminal block revisions	AF
10.	Repair damaged conduits	AF
11.	Auth Repr of C.O. (See Squadron II)	CE
	Total Value of Mods $21,212	

DA-6467, LOX Facil Addn (See Squadron II & III)

MOD NO.	DESCRIPTION	SOURCE
1.	Applicable to Squadron III only	AF
2.	Change fuel manifold	AF
3.	Applicable to Squadron II only	
4.	Repair relief valve of vessels	AF
5.	Applicable to Squadron II only	
6.	Applicable to Squadron II only	
7.	Applicable to Squadron II only	
8.	Applicable to Squadron II only	
9.	Standby costs (See Squadron II)	

10.	Add valves	AF
11.	Auth repr of C.O.	CE
	Total Value of Mod $14,839	

DA-6852, Facil Chgs (See Squadron II & III)

MOD NO.	DESCRIPTION	SOURCE
1.	Applicable to Squadron II only	
2.	Relocate Exhaust facilities	AF
3.	Relocate and reinstall motor generator	AF
4.	Applicable to Squadron III only	
5.	Revise painting	AF
6.	Exhaust duct	AF
7.	Auth repr of C. O. (See Squadron II & III)	
8.	Provide drawn line	AF
9.	Increase open press hot water system	AF
10.	Time Extension (See Squadron II & III)	
11.	Applicable to Squadron III only	
	Total Value of Mod $6,354	

DA-7147, Commun Duct, GM Assy

No Modifications.

SECTION 8

STRIKE DATA, ATLAS SQUADRON I

WARREN AIR FORCE BASE

1. On the morning of 15 April 1959, the cement finishers did not report for work. This was not a union-sanctioned strike, but an individual action of the ten cement finishers employed by the contractor over a dispute on payment of travel time. As of 0845 hours on 16 April 1959, the cement finishers established a picket line. On 17 April 1959, all crafts (425 men) observed the picket line. On Saturday, 18 April 1959 and Sunday, 19 April 1959, only partial crews returned to work. It was not until 20 April 1959 that the work was fully manned.

2. On Monday morning, 27 April 1959, the members of Local 192, plumbers and fitters, reported for work and then immediately left their jobs. Stoneman, Planetech and Automatic Sprinkler were involved. Approximately 170 men were involved. Apparent difficulty was that a General Foreman was alleged to have issued orders directly to journeymen in lieu of passing orders down through a foreman. Employees also want to work from 6 a.m. to 4:30 p.m. in lieu of 7 a.m. to 5:30 p.m. A settlement of dispute was effected on Wednesday morning, 29 April 1959. On that date, between 80 and 90 per cent of B. K. Stoneman Sons' employees reported for work and on Thursday, 30 April 1959, the production force was back to normal.

3. On 13 July 1959, the Operating Engineers walked off the job over a dispute of non-union employees of Knisely-Moore. In sympathy, the electrical employees of Fischbach & Moore walked off. The operating

engineers returned to work on 14 July 1959; however, when the electricians returned to work, two of them were told that they were fired. All of the electricians, (approximately 120 men) then walked off. Negotiations on Tuesday, 14 July 59 resulted in settlement. Electricians started returning to the job at 1000 hours on 15 July 1959. By noon, all but approximately twenty of the electricians involved had returned to work.

4. On Wednesday, 5 August 1959, a picket line was established by the Plumbers and Steamfitters because fitters had not been employed on the Nitrogen rechargers furnished and operated by Dynamic Research, Inc. This picket line was not removed until 1330 hours on 10 August 1960. The picket line was re-established on 15 August 1959 as a result of the International Office taking over jurisdiction of the local union and an apparent misunderstanding between B. K. Stoneman and the local as to who would not be rehired after the original picket line was removed on 10 August 1959. The second picket line was not removed until 1300 hours on 22 August 1960. Approximately 450 men were involved.

F. E. WARREN - SQUAD I

1.	Contract Number:	DA-25-066-eng-5064.
2.	Contractor:	Geo. A. Fuller Co., Los Angeles
3.	Brief description of the work:	Construction of Six Launchers (Atlas D)
4.	Using Service:	Air Force
5.	Final Contract Cost:	$19 734 219
6.	Date work stoppage began:	4-16-59
7.	Date work was resumed:	4-18-59
8.	Man-days lost:	948
9.	Number of work days lost:	2 plus parts of 2 days
10.	The union or craft involved:	Cement finishers, plus all crafts 4-17-59.
11.	Brief description of the cause of the stoppage:	Dispute over travel time - returned to work without it
12.	Total number of workers involved:	428
13.	Overtime work to recover lost by work stoppage, in man-days:	948 man-days
14.	Cost, if any, to the Government, for the additional overtime:	$32,945.
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 I

1.	Contract Number:	DA-25-066-eng-5064
2.	Contractor:	Geo. A. Fuller Co., Los Angeles
3.	Brief description of the work:	Construction of Six Launcers (Atlas D)
4.	Using Service:	Air Force
5.	Final Contract Cost:	$19 734 219
6.	Date work stoppage began:	4-27-59
7.	Date work was resumed:	4-29-59
8.	Man-days lost:	340
9.	Number of work days lost	2
10.	Union or craft involved:	Plumbers and Fitters
11.	Brief description of the cause of the stoppage:	General Foreman giving direct orders to employees
12.	Total number of workers involved:	148
13.	Overtime work to recover time lost by work stoppage, in man-days:	340 man-days
14.	Cost, if any, to the Government, for the additional overtime:	$17,400.
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 I

1.	Contract Number:	DA-25-066-eng-5064
2.	Contractor:	Geo. A. Fuller Co., Los Angeles
3.	Brief description of the work:	Construction of Six Launchers (Atlas D)
4.	Using Service:	Air Force
5.	Final contract cost:	$19 734 219
6.	Date work stoppage began:	7-13-59
7.	Date work was resumed:	7-15-59
8.	Man-days lost:	769
9.	Number of work days lost:	2
10.	Union or craft involved:	Electricians and Oper. Engrs.
11.	Brief description of the cause of work stoppage	Non-union operators on lay-down machine
12.	Total number of workers involved:	122
13.	Overtime work to recover time lost by work stoppage, in man-days:	769
14.	Cost, if any, to the Government, for the additional overtime:	$28,000.
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 I

1.	Contract Number:	DA-25-066-eng-5064
2.	Contractor:	Geo. A. Fuller Co., Los Angeles
3.	Brief description of the work:	Construction of Six Launchers (Atlas D)
4.	Using Service:	Air Force
5.	Final contract cost:	$19,734,219
6.	Date work stoppage began:	8-5 and 8-15-59.
7.	Date work was resumed:	8-11 and 8-22-59
8.	Man-days lost:	4,678
9.	Number of work days lost:	8
10.	Union or craft involved:	Plumbers and fitters
11.	Brief description of the cause of the stoppage:	Jurisdictional dispute
12.	Total number of workers involved:	341
13.	Overtime work to recover time lost by work stoppage, in man-days:	4,678
14.	Cost, if any, to the Government, for the additional overtime:	$182,000
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 I

1.	Contract Number:	DA-25-066-eng-5566
2.	Contractor:	Space Corporation Dallas, Texas
3.	Brief description of the work:	Squadron Maintenance Bldg.
4.	Using Service:	Air Force
5.	Final contract cost:	$1 237 449
6.	Date work stoppage began:	3-24-60
7.	Date work was resumed:	3-26-60
8.	Man-days lost:	10
9.	Number of work days lost:	2
10.	Union or craft involved:	All crafts
11.	Brief description of the cause of the stoppage:	Dispute over Convair IAM employees on site
12.	Total number of workers involved:	5
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

F. E. WARREN - SQUAD I

1.	Contract Number:	DA-25-066-eng-5566
2.	Contractor:	Space Corporation, Dallas, Texas
3.	Brief description of the work:	Squadron Maintenance Bldg.
4.	Using Service:	Air Force
5.	Final contract cost:	$1 237 449
6.	Date work stoppage began:	4-15-60
7.	Date work was resumed:	4-16-60
8.	Man-days lost:	3½
9.	Number of work days lost:	1
10.	Union or craft involved:	Electricians
11.	Brief description of the cause	Dispute over Convair IAM employees on site
12.	Total number of workers involved:	4
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

SECTION 8

DELAYING FACTORS, SQUADRON I

F.E. WARREN AIR FORCE BASE

1. SHOP DRAWINGS. Since the design of the Atlas squadrons was developed hurriedly some of the design had to be completed on the basis of shop drawings and, therefore an extremely large number of shop drawing submittals was required. A minor delaying factor was the failure of the contractor tofollow closely the status of his shop drawings and expedite the submittal of corrected drawings.

2. WEATHER. Considerable delay was encountered on Squadron I due to abnormal inclement weather.

3. CONTRACTOR STAFFING. Some delays resulted due to the contractor being shorthanded at one time or another. This development is natural when the work is so diversified and located in an isolated area. The contractor did not have full staff for the extraordinary effort of coordinating the required mechanical work with unusual installation and delivery requirements.

4. INSPECTION. Inspection at the sites presented serious problems due to the shortage of qualified personnel with sufficient experience in PLS work. The ceiling requirements placed on the Area and normal demands of employees for emergency leave left the inspection forces undermanned at the start of the program. However, numerous training programs and the engagement of outside specialists were used to remedy and avoid delays in staffing the inspection forces.

5. CHANGE ORDER CONFERENCES. Change Order conferences were not always effective. In some instances the conferences were announced on short notice at a far away place without an agenda so that it was physically impossible to furnish the right representative. Decisions made at CO conferences were not always made known on a timely basis. Occasionally there was no follow up to see that vigorous design action was being taken to avoid delays in construction.

6. CONTRACTOR-FURNISHED EQUIPMENT. This phase of the work was completely underestimated by the contractor who failed to use the early part of the contract time to maximum advantage by exerting pressure on supplier at early enough date to achieve timely delivery of all required equipment. Work needs required extraordinary measures toward prompt equipment delivery which were not fully implemented. Full time expeditors could not overcome the delays caused by tardy initiation of effective measures.

7. SPARE PARTS AND OPERATING MANUALS. Delays in furnishing these items were encountered principally because requirements were not clearly defined by the Using Service; also the contractor did not fully impress upon his subcontractors the absolute necessity for compliance with these requirements.

8. MODIFICATIONS. Due to the number and complexities of the modifications it was not always possible to reach a settlement in price prior to issuance of a Notice to Proceed. without delaying the prosecution of the work. As a result it was necessary to resort to the use of 2-part change orders. A diligent effort was put forth in negotiating settlements providing for payment and supplements were issued as negotiations were

completed on separable portions of the individual modifications. Sixty days additional time was granted for Modification 20 which covered febrications of PLS Skids and piping supports. Although no other time was authorized, it is estimated that a total delay of 200 days was caused by modifications. Unusually severe weather and on-site strikes caused approximately 25 days delay.

9. VISITORS. While not a direct delay factor it is believed that the large number of visitors to these first Atlas sites contributed to delays by the continuous interruption of key personnel in their assigned day to day functions.

10. DESIGN. Design and construction of the first Atlas D ICBM bases were carried out in a top-priority "crash" program manner in order to strengthen the national defense picture. For this reason adequate time was not available for the proper review of plans and specifications by the Using Service prior to award of contracts. One of the more serious reasons for delay in the design phase developed because technical requirements were fed piecemeal to the AF architect engineer who was faced with the necessity of releasing plans hurriedly in order to minimize construction delays. As a result neither the associated contractors nor the Corps of Engineers had the opportunity to perform adequate review of the changes in plans and specifications. Out of necessity much of the corrective action was applied on a "trial and error" basis as the problems arose.

11. SHOP DRAWINGS. An extremely large number of shop drawings was required for each squadron and some phases of design had to be completed on the basis of shop drawings. Many drawings had to be

resubmitted several times before they were accepted. This plus the voluminous correspondence required in processing shop drawings was time consuming and therefore a delaying factor. At the outset it was noted that AFBMD was not completely aware of the critical importance of shop drawings which resulted in a lack of sense of urgency in making decisions concerning the shop drawings. It was necessary to initiate extreme follow-up measures on all phases of shop drawing matters, particularly with respect to resubmittal of corrected drawings by the contractors.

SECTION 9

MAJOR ACCIDENTS

F. E. WARREN AFB

The outstanding aspect of the Cheyenne Area's safety program was that, during the life of the job, Government and contractor forces worked over 6,000,000 man-hours of exposure without experiencing a fatal accident. The 33 disabling injuries reported resulted in an injury frequency rate of 5.31 injuries per million man-hours worked. This frequency rate is slightly better than the average for all work under the Corps of Engineers, and about six times better than the average for the construction industry in the United States.

The accident that caused the greatest delay in the work was the $24,000 fire that destroyed a concrete batch plant on the George A. Fuller contract. This fire occurred during the early stages of this contract and concrete placement was held up approximately three weeks.

Enforcement of the safety program was made more difficult due to the complexity of the construction program and the number of contractors working in crowded areas.

In general contractors' cooperation with the safety program was "fair" to "good".

The credit for the good safety record on this project goes to the Area Engineer and members of his staff who put forth every effort to keep accidents to a minimum.

GEORGE A. FULLER CO.

CHEYENNE AREA

PERSONAL INJURIES

A truck driver suffered abrasion on ankle when Symons form panel fell against the ankle. Time Lost: 9 days. Occurred 13 September 1958.

A laborer suffered lacerations on left side of parietal region of head with slight concussion while operating an air compressor tamper. Vibration of tamper resulted in air hose coupling becoming unscrewed where it connects to tamper. Compression hose and coupling then whipped, striking employee on head. Time Lost: 4 days. Occurred 9 October 1958.

A welder suffered compound comminuted fracture of distal phalanx of left great toe when a $2\frac{1}{2}$"x8' piece of steel rolled off 3' high bench where he had laid it while reaching for second piece. Time Lost: 8 days. Occurred 8 October 1959.

A laborer suffered broken left ankle bone while working after dark in vicinity of Launcher 3 Area, Site A, when he walked outside the lighted area and fell into an open trench. Time Lost:4 days; Occurred 6 November 1958.

A laborer suffered bruised abdomen and ribs when caisson cover, on which he was standing, gave way and dropped him approximately 4' to bottom of caisson. Time Lost: 5 days. Occurred 6 March 1959.

Employees listed below were remvoing concrete forms on south haunch of Launch & Service Building No. 3 when 2x4 cross brace broke, dropping them 8 to

10 feet:

Carpenter - Chipped bone of left ankle. Time Lost: 5 days.
Carpenter - Fracture of left foot. Time Lost: 5 days.
Occurred 9 March 1959.

A carpenter suffered compressive fractures of 4th and 5th dorsal vertebrae and cut on head while stripping forms in 150,000-gallon reservoir, when part of forms gave way, hitting him on the head. (He was wearing a hard hat.) Time Lost: 30 days. Occurred 9 May 1959.

A steelworker suffered broken right ankle while using impact wrench in connection with steel work when wrench came apart, striking him on the ankle. Time Lost: 14 days. Occurred 5 June 1959.

An electrical foreman suffered torn ligaments and bad bruises of left knee while climbing into vendor's supply truck to check material when another truck rolled into him, pinning his knee between the two vehicles. Time Lost: 4 days. Occurred 12 June 1959.

An electrician suffered pierced left hand between No. 3 and No. 4 heads of metacarpal while firing a Remington Nail Gun. He thought gun was unloaded, picked it up with his right hand and at same time reached out with left hand to catch hold of gun (base) to change shield to offset position for firing. During this manipulation the gun fired, discharging a pellet which entered palm of left hand and came out back of hand approximately at base of middle finger. Time Lost: 10 days. Occurred 8 July 1959.

An electrician suffered slight concussion and neck injury while standing

Contractor: Doolittle Constr. Co.

Period: 1959-1960

Man-hours: 114,289

Disabling injuries: 1; Frequency rate, 8.75

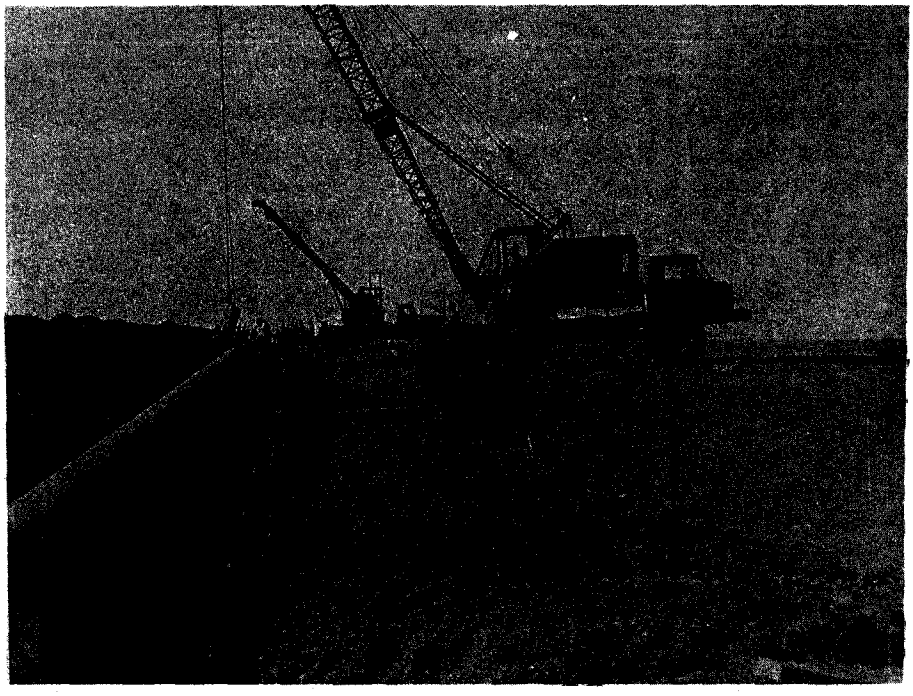
Days Lost: 4; Severity rate: 0.03

Property damage accidents: 1 *(Equipment)

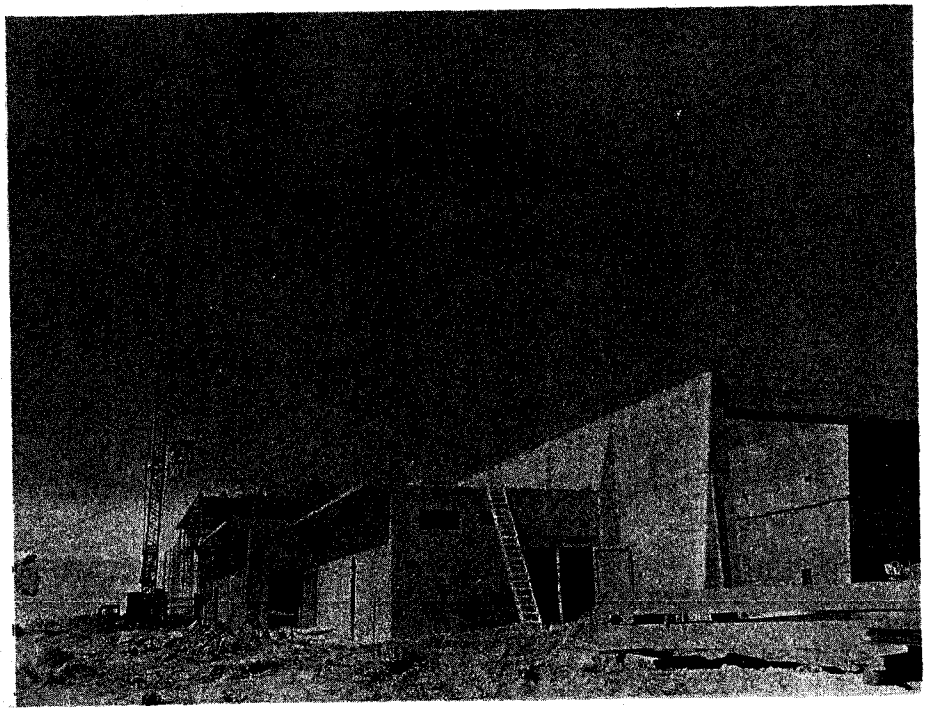
Amount of damage: $4,310

*Tractor ran into radio tower guy wire, causing tower to collapse.

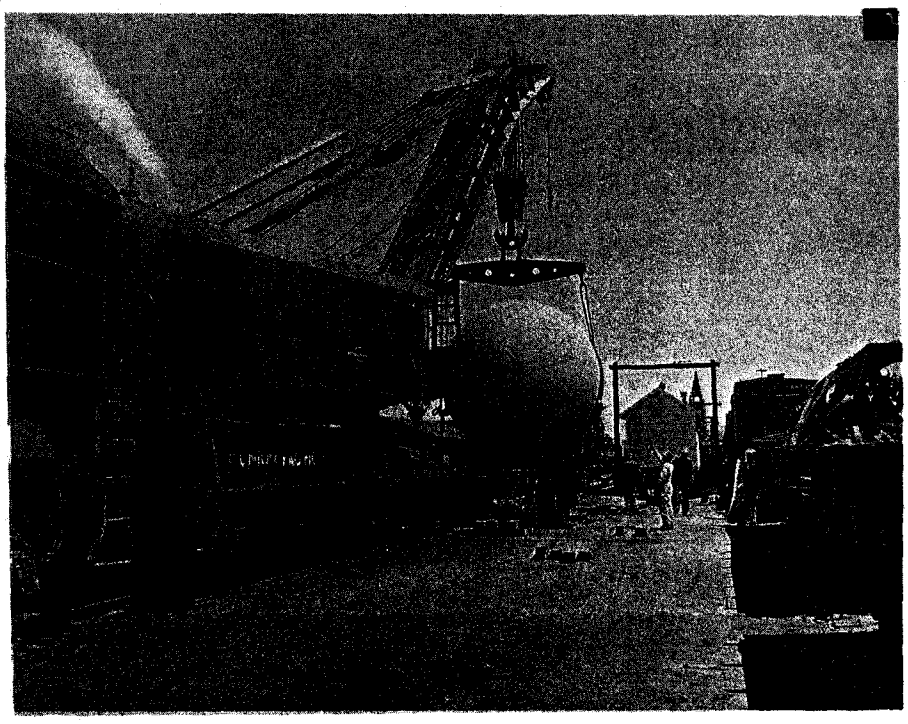
Date: Sep 29, 1958. DA-5064. F. E. Warren AFB, Launch Sqdn I Launcher #3, looking northeast shows fire wall thrust anchor keys and steel placement in fire walls.



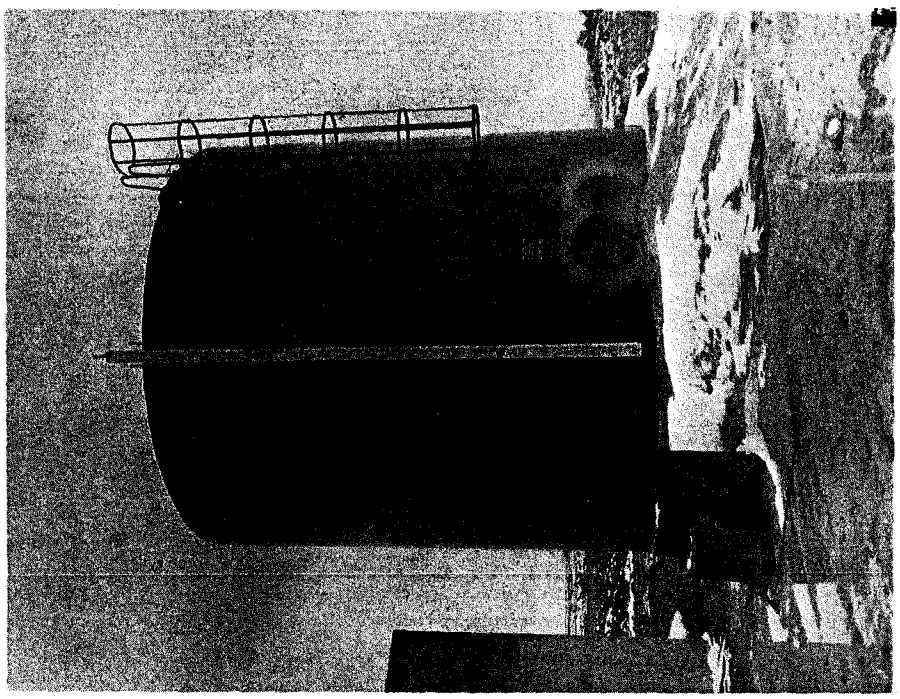
Date: Oct 15, 1958. DA-5064. F. E. Warren AFB Launch Facil & Util Squad I. View, looking west just north of Launcher #6, shows placement of 18" welded steel pipe line between Launchers #6 and #5.



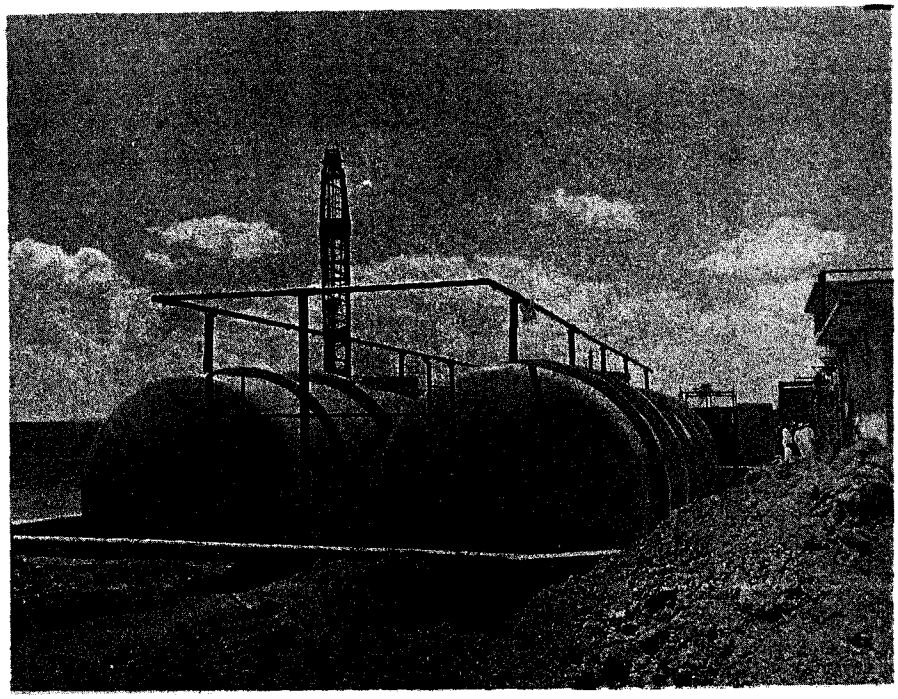
Date: Apr 23, 1959. DA-5064. F.E.Warren AFB, Launch Facil & Util. Squad I. Launcher #6. View, looking west-northwest, shows LOX Storage Area and south wall of Missile Storage Bay, Room #100.



Date: May 12, 1959. DA-5064; F.E.Warren AFB, Launch Facil & Util. Squad I, Site A. View, shows end of flatcar with liquid oxygen tank off track. This maneuver was necessary to gain clearance for crane on adjacent track to lift tank from flatcar.

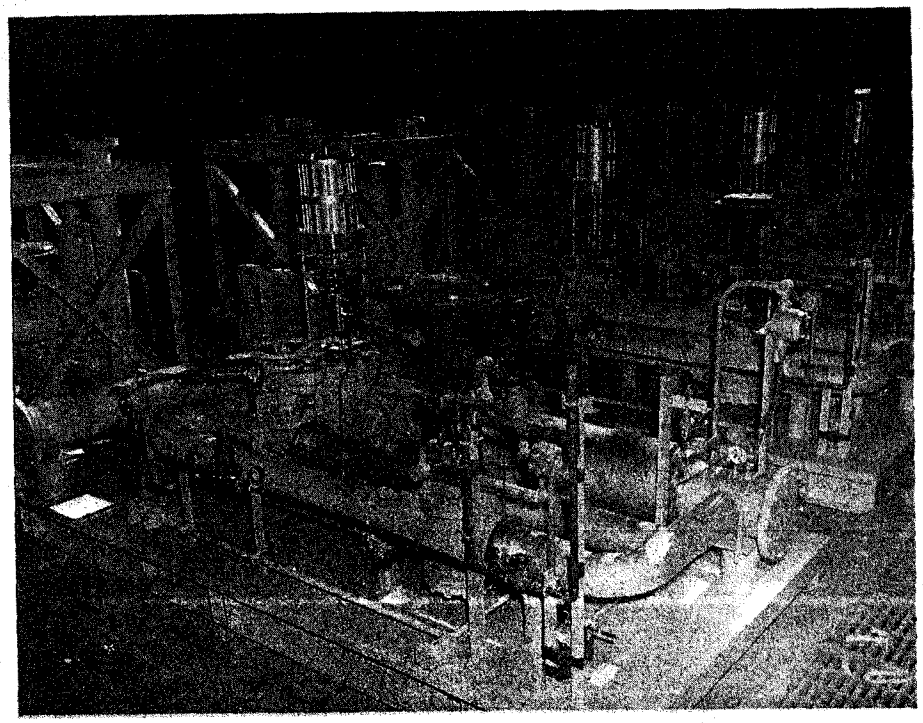


Date: 22 May 1959. DA-5064. F.E.Warren AFB,Cheyenne,Wyo.Launch Facil & Util. Squad I. Site A. Pump House #4, view looking northeast shows 75,000 Gal. reservoir, no exterior painting.



Date: June 8, 1959. DA-5064. F.E.Warren AFB,Cheyenne,Wyo.Launch Facil & Util. Squad I. Site A, Launcher #1, view looking west showing Liquid Oxygen tanks, showing firex piping.

Date: Aug 24, 1959. DA-5064. F.E.Warren AFB; Launch Facil & Util. Squad I, Site A. Launcher #5. View, looking east-northeast, shows north waste channel walls with drain outlets. Walls have been smoothed to receive gunite.



Date: Oct 15, 1959. DA-5464, Ottumwa,Ia. Furnish PLS and Skid Assemblies. Overall view of skid #2 - fuel control valve skid - WC-1 ready for shipment. Discharge side.