SECTION V

PROBLEM AREAS

PART I - GENERAL

The staffing of sufficient and qualified personnel came late in the life of the Area Office. This caused a great backlog of work to build up as various sections of this history points out, particularly in the field of estimating, negotiations, settlement of modifications and in some aspects supervision of construction. It is believed that had the qualified estimating personnel been staffed from the beginning of the project, the Government would have been in a much better position to force negotiation action on the part of the Contractor.

The frequency and scope of the many modification to Contract No. DA-5919 seriously affected the controlling features of work. The net increase of construction work to be performed under the contract was large, but even more serious was the modification of previously modified work. Construction work was almost constantly being performed that resulted in no progress toward completion because it had to be redone due to further changes. This condition created confusion as well as tremendous scheduling problems. This problem was part of a condition which became known as "impact". The impact factors were extremely difficult to visualize and evaluate.

The Area was not able to obtain information necessary, in a systematic method, for preparation of Government estimates for Change Orders at the time such changes were put into effect. This opened the door for much uncertainty and variance in the initial Government estimates.

Change of command from the Omaha District Office to CEBMCO created for a short while confusion of responsibilities of the new Headquarters and the Servicing District.

This office has experienced numerous delays effecting the receipt of guarantee documents in accordance with CEBMCO Circular 61-3, which requires that "name of prime contractor with complete address and telephone number; and the names, addresses and telephone numbers of all subcontractors and/or equipment suppliers or manufacturers specifically designated in writing by the prime contractor for direct contact." This circular was issued on 9 January 1961, approximately 13 months after the contract award and beginning of construction. This meant that the majority of the guarantees were in the possession of the Government and it was then necessary to request the contractor to furnish the information as required by the above mentioned CEBMCO Circular.

PART II -- SITE LOCATIONS, CLIMATE, LOCAL ECONOMY AND LABOR

There were difficulties and problems that arose as to site location, climatic conditions and economy - labor that effected the prime contractor operations on Contract DA-5919, with resulting effects on the Area Office operations. All of these difficulties materially effected the contractor's original and supplemental proposals and had to be taken into consideration by the Area. It must be stated at this point that these difficulties were overcome in the face of a rigid construction and other difficulties experienced.

Construction operations occurred over a circular 3600 square mile area radiating an average roadway distance of 34 miles from Rapid City, South Dakota, to the three principal work sites. The average 68 miles separating the three major work sites required triplication of field supervision and minor spare parts storage in order to simultaneously prosecute the work. Local minor parts availability was frequently insufficient to needs and such minor items as special nuts, bolts and screws had to be procured from metropolitan areas 300 miles or more removed.

Normal climatic conditions that had to be considered during the December to March periods requires either cessation or expensive winterization for major general construction activities. The brief and rigid construction schedule imposed on the contractors by military necessity required continued winter operation (e.g. major excavation

and backfill while normal frost depth exceeded 2 feet, heated inclosures and heated materials for concrete). Snow presented no local problem; however, infrequent high winds (60 to 80 MPH), several extended periods (3 to 4 weeks) of intense cold (0° to 10° F daily highs), and rare but intense rainfalls were major climatic conditions overcome during the work.

The local economy is primarily a sparsely populated agricultural-cattle ranch type with a limited supply of skilled construction labor. This economy had a major influence on the labor available to the contractors. There was a lack of sufficient amounts of skilled labor (labor actually was plentiful in number but not in skill, although there was less sufficiency of labor at remote locations). With the number of airbase projects, and lesser local projects going, the labor demand naturally became acute. Supplemental overtime, dislocation and travel allowances in one form or another were needed to entice and retain sufficient skilled manpower to complete the work. Labor was recruited from outside sources at premium allowances which in the case of more professional skills accounted for cost rises as the situation became more acute. In addition, the remoteness of the location made it difficult to attract the most efficient type labor physically employed elsewhere; consequently, the rate of production was somewhat lower than in other areas, also contributing to greater costs. In the case of electrical trades, this accounted for at least 10 per cent increased costs. With respect to labor disputes, some minor effects were felt such as the G. E. strike, but no major costs due to strikes were entailed for the project.

PART III -- PROPELLANT LOADING SYSTEM

PROBLEM AREAS

The construction of the Propellant Loading System was an extremely complicated and difficult phase. With the construction came many problem areas. Some were minor not affecting the project seriously; the following are a few that have been selected as major ones and are presented for interest:

CONTRACTOR'S CLEANING PLANT

The contractor's cleaning plant presented the first major PLS problem encountered. The PLS piping could not be cleaned in one easy operation as anticipated. Many pieces of stainless steel piping were destroyed by over-etching which occurred in the cleaning process. This problem was eventually solved by obtaining suitable acid pickling times and vigorous hand polishing and brushing of the pipe, particularly in the weld areas. Following the resolving of problems encountered, the plant reached a cleaning capability of approximately 30 spools per day to meet installation requirements. During some peak days, approximately 40 - 45 spools were cleaned.

CONTAMINATED TESTING MEDIA

One of the major problems encountered was the inability of the Government to provide the contractor with clean Liquid Nitrogen and RP-1 as required by contract specifications. This problem was encountered in January of 1961 and remained a constant problem until August 1961. Despite numerous attempts by both the Government and the contractor

to obtain ample filtering of the Liquid Nitrogen, few clean samples were ever obtained. Finally, it was quickly determined that much of the contamination problem lay with the laboratory itself. Following the clean-up of laboratory methods, contaminated liquid nitrogen disappeared as a major operational problem.

CONTAMINATED STANDARDIZED EQUIPMENT

The large majority of the valves and all of the vessels used in the Propellant Loading System were supplied under Standardized Equipment contracts. By inspections performed in early December 1960, before the start of field installation, it was found that the majority of these Standardized Equipment components were contaminated. In the middle of January 1961, the contractor was directed to begin inspection on all Standardized Equipment components. This inspection immediately indicated that approximately 95% of the components did not meet the systems standard for cleanliness. CompuDyne, a standardized equipment supplier, was directed to re-clean all valves, filters and other components supplied by them. The re-cleaning commenced about 7 February and was substantially completed within 30 days. Field operations were hampered by the lack of valves and other components, since piping had to be installed in small segments and couldn't progress on a smooth basis. LOX Equipment Company was directed to inspect vessels supplied by them. The first vessel was inspected on 28 March 1961. Approximately one half of the vessels inspected had to be re-cleaned. The re-cleaning was accomplished by purging the tank with clean, dry air and doing a touch-up type cleaning job.

Blowdowns and system samples indicated that both the valve re-cleaning and the vessel re-cleaning had been done in a satisfactory manner.

PRE-TEST INSPECTION

Early attempts by the contractor on pre-test inspection were poorly organized, inconsistent and generally ineffective. A specialized punch list team of the most experienced people available was established. This same team was used to compile punch lists throughout the job. Armed with the latest drawings, these people performed top rate inspections in the minimum of time and contributed greatly to the task of finishing the PLS construction in time to allow testing to be completed on schedule.

SEAT LEAKAGE OF KEILEY-MUELLER VALVES

As testing neared completion in the last Propellant Terminal at Complex 1C, and as other Propellant Terminals were in the process of being placed in stand-by condition, it was noted that the standby condition could not be achieved because of excess leakage across the seats of the Keiley-Mueller valves. Upon disassembly, it was found that the seats of these valves had been crushed by the actuation of the valve plug. A further investigation revealed that approximately 8 such broken seats had been encountered. The occurrence of this seat breakage in the 8 valves cast a shadow of doubt upon the condition of the remaining valves whose seat design was the same. It was found that 17 valves per Propellant Terminal had this type of seat design and were thus upon to question. It was decided to immediately go back

to all Propellant Terminals and re-check these valves for seat leakage. The re-check indicated that approximately 10% of the valves leaked across the seat.

The contractor was directed to check the spring tension on all valves and to leak check all valves across the valve seats. Any valves which leaked were to be disassembled and repaired. The trouble was eventually traced to defective material in certain valve seats and plugs. Kieley-Mueller replaced all defective seats and plugs.

PART IV -- CHANGES

Throughout the span of Contract DA-5919, changes that resulted in modifications were continuously in the offering. These changes resulted in excessive costs, hampering the progress of the facility construction contractor and settlement of modifications. Following are resumes of some of the more serious changes that effected the project:

PIPE AND PIPE SUPPORTS

Pipe and pipe support changes accounted for over two and one-half million dollars worth of additional work and occurred over a year after construction had started. The bulk of these support design changes were not available until after the substantial portion of the piping was installed, either with the original supports or temporary supports. The impact both time-wise and money-wise was extremely serious. It entailed hours of lost time in tearing out previously installed work and/or temporary supports with the subsequent delays of obtaining the properly designed supports. In addition, this delayed (piping and pipe supports) work from its schedule prior to joint occupancy which would require the work to be done under the maximum cost period. Specific examples are as follows:

Pipe supports were added to Propellant Terminal, LOX Tunnel Area and Missile Silo Propellant Loading System. A great many of these supports were of stainless steel. These supports were considered necessary after the A. D. Little Company conducted a stress analysis for the Air Force on the Propellant Loading System.

Pipe supports for the entire Firewater, Utility and RP-1 Systems on the Missile Silo walls were redesigned due to their not being adequately detailed or provided on the original contract drawings.

FLEXIBLE HOSE CONNECTIONS

Flexible hose connections were substituted in lieu of expansion joints and the pipe sleeves revised in the firewall between the Powerhouse and Tunnel Junction No. 10. Pressure testing of utility lines extending from the Powerhouse resulted in distortion of the expansion joints and anchors. It was determined necessary to replace the expansion joints with flexible hose connections and to revise the anchors for the utility lines. These changes were required to provide a workable system which would not move and become distorted or damaged during pressure testing and normal use.

BLAST VALVES

The size and material of the locking pins for the blast valves were changed and lubricators were added. The lubricators were not included in the original design, but it was determined that they were required to keep the blast valves functioning under operating conditions. The modification was brought about by the failure of some valves after being cycled a number of times under operating conditions.

FIRE WATER SYSTEM

The Fire Water System was revised by relocating valves SV-809-1, 2 and 3 and ARV-802-1, 2 and 3 along with their supports. The pressure settings on various valves throughout the system were changed

along with changes in various controls. These changes were required to remove entrained air which would interfere with the operation of the control valves and to insure proper sequencing and functioning of the components of the Fire Water System.

TESTING

Extensive clarifications, corrections and additional testing were added under 10 major testing modifications from March to August 1961, just prior to completion. This again accounted for over two million dollars worth of additional work and again delayed completion of work. Specific examples as follows:

Complete validation test procedures for all systems and components of one complex were provided in Modification No. 128. The complete validation tests were added to obtain data which could be used to determine whether or not the design conditions were met and for design evaluation.

The Propellant Loading System acceptance Test Procedures, contained in Section 39 of the Specifications, were completely rewritten. The intent of the rewrite was to provide a test procedure which was complete and detailed. The revised section is detailed and explicit in designating each step to be accomplished during testing. This change eliminated the requirement that the contractor furnish a test procedure.

PART V -- JOINT OCCUPANCY, INTERFERENCE AND ACCELERATION

THE EFFECTS OF JOINT OCCUPANCY

The effects of joint occupancy have been major. Workmen's congestion was a general factor. Simultaneous operation by facility contractor and Air Force associates in the Antenna Silos was resolved by exclusion of each contractor from one of the two silos while the other performed work in the remaining silo. Operations in the missile silos were the most difficult, as frequently, scaffolding built in one local area was removed several times within a two or three week period. Work in one area would await scaffold construction, which in turn was awaiting completion of other work that was progressing only two or three feet below the desired work area. Another general effect was the requirement imposed upon the facility contractor to protect his already completed work and maintain repair forces to repair work possibly damaged by Air Force associate workers.

Control of certain Air Force associates was almost nil in that they failed to adhere to synchronized schedules and frequently displayed complete disregard for the work of other contractors. One excellent example by an associated contractor was their unscheduled, premature entrance into a missile silo at Complex 1C on a Sunday when they indiscriminately removed scaffolding in their way and threw it to the bottom of the silo. It was three or four days before the scaffold could be rebuilt and months before ductwork was repaired. The general repair of all ductwork in the missile silos at three complexes

was performed mostly at Government expense as responsibility in most cases could not be fixed.

The fact that the Air Force associate contractors had completed major portions of their work, during the same period the Corps of Engineers had completed their contract, indicates the overall program has materially benefited.

EFFECTS OF INTERFERENCE

In the final phases of the project, there were another group of changes valued at over 2 million dollars that caused a tremendous interference problem. These problems occurred primarily from failure of the Architect-Engineer to coordinate his structural, electrical and mechanical drawings from failure to consider compositely all of the incoming associated contractor installed missile equipment, and as a result of conflict caused by the previous issued pipe and pipe support modifications. These interferences were not clearly determined until they became obvious when all trades and contractors - both prime and Air Force supporting contractors, attempted to install their respective facilities in the locations as spelled out on their respective contract drawings. At this point, over 1,500 interferences became apparent which necessitated on-the-spot corrections and/or relocations, delaying all concerned at time of joint occupancy, when such corrective effort was slow, expensive and time consuming. The impact of this problem is still continuing and represents one of the greatest impacts on the job. The remaining changes constitute a multitude of minor design changes and/or corrections for errors and omissions in the plans

and specifications. The most significant of these being Modification Nos. 3, 36, 54 and a group of electrical communication conduit and wiring changes which entailed revising almost one-half of the contract drawings. These types of changes cause serious delays in submittal and approval of shop drawings, ordering of materials and job management, which were subsequently felt in claims as well. Modification No. 3 in itself caused erection of an on-site cleaning plant due to more stringent cleaning requirements (which were subsequently cancelled because of excessive costs) as well as adding water cure in lieu of membrane curings to major concrete work at the site. The water cure proved to be much more time consuming and delaying subsequent concrete placement. It also was very damaging to embedded ferrous items. This multitude of minor changes had a serious impact on the project.

EFFECTS OF ACCELERATION

The original specifications forewarned the contractor that original project completion dates would have to be met, and provided that the Contracting Officer, in the case of excusable delays, could order acceleration efforts to be expended and compensate for such under the provisions of Clause 3. For this purpose, the Area Engineer was authorized $1,000 approval authority, the local SATAF office $25,000 and higher echelons for any over these amounts. In accordance with these policies for the first 80 modifications issued up to 16 December 1960, it was approved and understood the completion dates would be met by whatever means necessary to overcome any justifiable delays. The consequences of this, in view of the extensive changes being made, were twofold;

namely, placing the modification work itself on a 54 - 60 hour week and taking such action on subsequently delayed original contract work as necessary to overcome such delays. These measures would include, but not be limited to, overtime, multiple shifting and increase in labor, plant and equipment to the extent possible. For the purposes of identification, the word impact and effect were adopted. Impact pertained to accomplishment of the change order work, whereas effect represented acceleration of original contract work to meet the current completion dates. To date, from the standpoint of cost growth for the project, these factors accounted for over 1/2 million dollars. However, they resulted in making it physically possible to meet Air Force need dates. As to modification settlements, this had an adverse effect and was time consuming, as it led to an extensive amount of research and record keeping to effect equitable settlements. Also, it has led to numerous claims.

PART VI -- THE UNIQUE PROBLEM OF GROUND WATER AND WELLS

COMPLEX 1C

The abnormal groundwater condition, combined with chemically active water that showed up in the wells at Complex 1C, accounted for another 1/2 million dollars worth of modifications. These basically stem from two sources; namely, extremely hard water which required extensive redesign of its treatment and necessitated early replacement of casing, etc., and the high pressure artesion flow from the well which resulted in complete redesign of pumping facilities. All of the required changes were not made firm until the latter part of the project, which accounted for delays and extensive cost at Complex 1C. This was in part due to failure to consider earlier the actual water conditions at Complex 1C.

Ground water conditions at Complex 1C were abnormal in that they differed from expectations made as a result of test-drilled holes prior to contract award. The chalk strata was severely fractured in its natural condition and permitted close flow of ground water between Missile Silo 1 and 2. After excavation of Missile Silo 2 was completed to its full depth, a flow of 25 gallons per minute was encountered for a period of more than 3 months; after this time, such flow diminished to a steady rate of 8 gallons per minute over a year's period; with a continued constant pumping the flow of approximately 8 gallons per minute has now been undiminished for more than 6 months.

After the completion of excavation of Antenna Silo No. 1, ground

water entered the bottom of the excavation from crumbly line chalk faults, at a rate of 5 gallons per minute. This flow was trapped by the concrete base of the silo in which gravel was placed and a 6 inch perforated pipe was installed for better control of the water. After a long period of drainage, the flow stabilized to approximately 3 gallons per minute.

The deep wells in the Powerhouse at Complex 1C required extensive revisions due to conditions not foreseen on the original Raw Water System design. The East well was a high producing artesian well and the West well was a low producing deep well. Both wells were grouted to prevent interchange between the wells and to prevent surface inflow into the outer annulus. The wells were grouted in a manner so as to form a cylindrical concrete shell around the well. The annular spaces between the 18" O.D. casing and the 12 3/4" O.D. casing on the West well and the 10' 3/4" O.D. casing on the East well were grouted to a depth of -300 feet. From this elevation, the West well was grouted to form an incasement 16 1/4" in diameter to a depth of -360 feet and the East well to a diameter of 16" to a depth of -528 feet.