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Oral history interview with Jack P. Shields
[full name of interviewee]

about Construction of Facilities
[main focus of interview]

Title: Corps of Engineers
[interviewee's current and/or former title and affiliation]

Interview conducted by Robert B. Merrifield - Staff
[interviewer's name/position]

Historian at MSC
[location of interview]

Transcript and tape(s). [for inventory only: # pages 13; # tapes 1]

CONTENTS:

Biographical - [date/place of birth; family background] _____

Education - _____

Career Path - _____

Topics - Aug 1962 - Work at MSC Site began; initial Contract:

tunnels, water mains, drainage, streets. Phase II:
central heating plant, fire Sta + Bag 12 (Data Processing);
Phase III: 13 buildings; Phase IV: completion; Phase V:
10 buildings; problems w/ Chamber A + Centrifuge
Construction; testing Optical Frequency Range vessel;
Specific on Construction claims against govt; relationship
between Corps of Engineers + Facilities Div; weekly +
monthly Coordination meetings; cost limits
on design changes; MSC changes put
Corps in bind; ~~need~~ ^{face} "face to face"
communications a problem; personality
differences; as-built drawings + inspections;

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Interview with Jack P. Shields
8/1/68

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Basically we started off with NAS-1, the initial construction contract at Manned Spacecraft Center, Houston. This was primarily for construction of the underground tunnel system, the water mains, and the primary draining of the 1620 acres of land, which in the building areas was graded to $\pm$ approximately 2 feet of the finished elevation. The main streets were also put in under this contract up to sub base course level which left the asphalt paving to be done in future contracts. I started working at the Site in August 1962.

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There were basically four main construction contracts - Phase I, was the main road and primary grading with main utilities. Phase II provided for three main buildings: the ~~power house~~ ^{Central Heating Plant,}, the fire station, and Bldg 12, the Data Processing Bldg. It also provided for putting asphalt on the original roads ^{and} for installing piping ^{from} to the ~~power~~ ^{Central Heating Plant}, to the first three buildings plus additional piping for future expansion in the existing tunnels. Phase III, was one of the larger building contracts, and provided for 13 buildings to be serviced by the primary existing utility tunnel system and other systems which were under operation. The 13 buildings were primarily for NASA personnel then located in some 11 to 16 buildings in the Houston area, and at Ellington Air Force Base. These buildings had a short completion date--approximately one year, and a cost of around \$20 million. Many changes were made in some of these buildings because of alteration of design concepts after award of the contract. Building 8 in particular was to have been an office building originally, during the construction medical facilities were added to it, and a large modification was made just before the

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building was finished to provide for photo services. This caused many problems with the prime contractor in that he would already have completed a lot of work that would have to be removed. This happened in about 5 of the buildings under the Phase III contract. Phase IV was primarily a completion effort on the part of the original design concept to finish existing streets, widening them to the original design criteria of 4 lanes, and adding an additional tunnel for several individual buildings. It also provided for two new buildings - Bldg 5 and Bldg 29. Along with Phase V work, approximately 10 buildings were constructed. Included in these 10 were several major buildings such as Bldg 49, 49A, and 14 which houses the Anechoic Chamber and the optical frequency range (the largest anechoic chamber that has been built to date). Also 32 which is the Space Environmental Test Laboratory. It was built by 3 different construction contractors. The first contract called for construction of the two test chambers--Chamber A and Chamber B. Chamber B did not cause any great problems. The deflection of the door of Chamber A when it was tested made necessary a lot of rework including a stop order of approximately 1 year's duration for the construction contractor while the chamber was being redesigned to correct the defects.

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Building 29 ~~is~~ was built by one contractor. The Westinghouse motor was furnished by the NASA Contract and the arm and gondola with all related necessary equipment was furnished under another construction contract monitored by the Corps of Engineers. Great difficulty was encountered with the design and construction of the centrifuge arm, gondola and gimbal ring. The first gondola that was

built by Lockheed under subcontract with Rucker Company imploded on initial tests. The second design effort was made and a new gondola was constructed within a period of 90 days and tested satisfactorily to the requirements of the user. The gimbal ring was built by Martin Marietta of Baltimore of high tensile strength steel, and in the process of welding, was very susceptible to cracking. Many problems were encountered in the construction and testing of the gimbal ring before final acceptance could be made. This covered a period of approximately one year. The same material was utilized in the construction of the arm and was tested by the Navy. The arm segments were tested to destruction to assure that adequate strength was inherent in the machine. Bldg 14 was built after Bldg 29 and 32 and contains an OFR (Optical Frequency Range. It was another vacuum vessel, constructed by AMF Beard in Freeport, and was approximately 13' in diameter and 260' long. Inasmuch as failures had been encountered in previous vacuum testing of Chamber A and the gondola, great effort was expended on the part of the Corps of Engineers and NASA to get expert opinion that the design was satisfactory and that the vessel would withstand the vacuum testing required. This generated some claims and also some heated arguments between the Corps of Engineers, NASA people, and the construction contractor as to whether the design was adequate. Corps of Engineers hired an outside consultant to review the design and it was his opinion that the vessel as presently designed would not withstand the necessary test of 20 psig internal nor 10^{-3} external vacuum. NASA engineers were also of the same opinion. We attempted to get more design criteria from the construction

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contractor and were unsuccessful. The contractor built a 1/4 scale test model of this chamber and tested it in their plant. Then utilizing a larger shell and filling it full of water, it was pressurized to exert the necessary forces on the external side of the model. The test proved satisfactory, in fact, AMF Beard removed the added stiffeners from the test model which had been required by the Corps on the original design and the model still withstood all of the external pressures. This test satisfied both NASA and the Corps of Engineers and we proceeded to test the actual vessel. Tests on the actual facility almost paralleled results obtained from the model testing. It is the opinion of the Corps of Engineers that this type of testing should be accomplished on all future designs of this type, particularly in the vacuum area. This would have proven very successful for the chamber in Bldg 32.

It was rather difficult at times to communicate with the users of the facility. Many changes were dictated by NASA as being the intent of the specifications, and these later ended up as modifications or claims which were paid to the construction contractor. It has since been recommended by Mr. Piland that in the future, the Corps of Engineers consider utilizing cost plus incentive fee contracts on this type of construction where the design is being changed concurrent with construction.

The dollar amount and the number of claims against the government, in my opinion, were small when it is remembered that the Corps of Engineers did approximately \$150 million worth of work on the site. The claims that went before the Board of Contractor Appeals amounted to

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less than \$1 million. The claims that have been heard by the Board are as follows: The first claim was Ets. Hokin and Galvin on Bldg 30 regarding electronic fire detection equipment in the amount of approximately \$450,000. This claim was won by the Government at the board of contract appeals level. It was later appealed to the Court of Claims by the contractor and no decision has yet been rendered. The next claim was from C. H. Leavell - regarding insulation of the flexible connection to the light fixtures, and this was for \$125,000. This claim was also won by the Government and has also been appealed to the Court of Claims and no decision has yet been rendered. The next was on the spring isolaters for Bldg 14 on Chaney and James contract. This was in the amount of approximately \$20,000 and a decision has not yet been rendered by the Board of Contract Appeals, but it is the opinion of the Government that we will also win this one. Another claim was for overtime for pipe fitters on various NASA contracts by one subcontractor -- Natkin & Co. He did work under five different prime contracts NAS-117, the power house; NAS-118, Bldg 45; NAS-123, Bldg 31; NAS-129, Bldg 32; and I'll think of the other one later on. These five separate claims involved the same issue - overtime pay. These have yet to be heard by the Board. One other claim pending before the Board of Contract Appeals pertained to the same problem (overtime for pipe fitters) and it involved C. Wallace, the sub to the mechanical on ~~Chamber A~~ ^{Building 440.} It amounts to approximately \$12,000. No decision has been reached by the Board on this claim, but the Government does not see any merit in this claim either. The five claims with Natkin total approximately

\$75,000 or between \$10,000 and \$15,000 for each contract.

33 ✓ Other claims have been dropped at the contracting officer's level or the contracting officer decided that the claim had some merit and they were negotiated with the contractor and written into modifications. Many of the changes were generated by NASA and were later made into modifications. During the five years that I was at the MSC, we processed approximately 1500 change orders. Many of these changes came late in the year or when the buildings were almost finished, making the contractor reschedule, reorder materials, etc., in an effort to allow NASA personnel to move into the buildings on the dates established previously. All of the move-in dates for the major move to Clear Lake Site were met and NASA did not have to extend the leases in the buildings they occupied downtown.

334 The main reason that the Corps of Engineers had more claims than MSC did for the contracts it administered was that most of the contracts administered by NASA were for minor construction and usually involved less than \$200,000. A small contractor seldom has lawyers on his payroll and is less likely to bring suit; it is easier to administer these smaller type contracts without claims. The Corps of Engineers has found that smaller contracts generate very few claims. I think this is the main reason that NASA has only one claim. I am not familiar with their procurement proceedings but the Lunar Receiving Laboratory was a cost plus fixed fee incentive type contract, which by its very nature would eliminate claims. On the SESL structure where we had deformation of the chamber door, we had no reason to believe that would not test satisfactorily. We had previously tested Chamber B

240 and the chamber proved satisfactory when tested to the 10^{-7} as required by the contract. We as well as everybody else on this project learned a lot. On the OFR vessel we utilized recorders and 236 other instrumentation, at all of the strain points to measure the amount of deflection that the vessel was undergoing during the testing. The contract with Industrial Fisher Diversified for Bldg 32 was initially for \$9.8 million and the final cost was \$17.4 million. This was due to several reasons. First the stop order forced upon the construction contractor at the time of the failure of the chamber door, caused approximately a 1 year delay in the contract and this action cost the Government \$2.1 million. Second another \$5 or \$6 232 million was brought on by design and criteria changes. In many cases the contractor would install something today according to specifications, only to have the user change his design concept. The Corps would be forced to tell the contractor to take that particular item out and order something else and install it. This generates costs.

334 The Corps sometimes had difficulty in staying within the CWE as allotted for any particular building. The MSC design criteria required facilities that could not be installed and still stay within the CWE. A good example was the 2nd cafeteria. The original design called for complete kitchen facilities, whereas money was only adequate to provide a small amount of kitchen facilities and the main cafeteria would have to be utilized. We finally resolved the problem by having the same concessionaire operate both cafeterias. He utilized the main cafeteria for preparing all his major foods and utilized hot and cold carts to transport it between the two cafeterias in a truck. Thus it

was not necessary to duplicate kitchens in both cafeterias. This saved approximately \$250 - \$300,000.

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The relationship between the Corps of Engineers and the Facilities Division in most instances was very good. Of course there were many problems and many differences of opinion. Many of the problems were alleviated through coordination meetings held every Wednesday. Representatives of the Corps, MSC's Facilities Division and sometimes the NASA user were usually present to make sure everyone understood the problems being encountered, whether it be construction, money, etc. These meetings helped get the job accomplished. They were particularly helpful during the time of the initial move to the Site. Much coordination had to be done, many hours of overtime were worked by both NASA and Corps personnel in an effort to coordinate and accomplish this move. Most of the moving began on Friday afternoon when the offices were closed. Occasionally a construction contractor still had control of the buildings, and it was necessary for contractor's electricians to be working on the site. Union problems sometimes developed. In the multi-story buildings, the union would not let NASA people run the elevators, therefore it was necessary for the Corps to pay elevator operators to work around the clock to see that furniture and other equipment was moved over the weekend that had been set aside for this purpose so that the customer could open for business the following Monday morning. Money was often a matter of consideration in these coordination meetings. We discussed changes that were generated by the user, the Facilities Division, or by the Corps, and how we could accomplish these changes. Sometimes at these meetings it was determined that these changes had to be made lesser or greater depending

143 on the needs of the user and the availability of funds; sometimes we would have to cut out items that were desired, and then we would go back and get another price from the contractor. Another meeting between the Corps of Engineers and Facilities personnel was normally held on a monthly basis and this provided for the approving of change orders, and appropriating the money for them. Mr. Zbanek acted as chairman. Personnel from MSC Facilities and Engineering Divisions and from engineering and construction elements of the Corps of Engineers were also members. I represented the construction side of the house for the Corps at these meetings and also acted as chairman of the coordinating group meeting for approximately the last 2-3 years. The Corps had authority to approve field changes up to \$8,000 without approval of the committee. These changes were presented to the committee so that control of funds could be maintained. Mr. Zbanek could also approve design changes up to \$8,000. Changes by MSC or Corps of Engineers, which were above \$8,000 could be recommended by the committee for approval but final approval rested with Mr. Piland, of MSC. This committee eliminated some of the changes that were considered non-essential. However, sometimes many heated arguments developed because of changes made by the Corps of Engineers which were considered to be field changes and not agreed to by NASA. In most cases the Corps of Engineers proceeded to make the changes in the field that they considered necessary to get the buildings completed. Also many times the Engineering Division

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personnel of MSC questioned the dollar value as estimated by the Corps of Engineers. Here again some of our estimates were not exact. Some of them were "guess-timates" instead of estimates. Because of the many changes that were made on some of the contracts, complete estimates could not be made in the short time available, and therefore this is one reason for the difference of opinions sometimes. My personal opinion of the weaknesses and strengths in personnel of the Corps, particularly on the NASA side, was the inability of some NASA people to adhere to the final decision that had been previously agreed on with the Corps of Engineers. Some people would agree to a certain course of actions, the Corps would proceed to do it and when the job was half finished, then somebody else with higher authority with MSC would oppose it, leaving the Corps of Engineers holding the bag and at the mercy of MSC.

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Here again the Corps of Engineers, in my opinion, had problems in our own staffing. We maintained two offices, one at EAFB which contained the Engineering Division, and one at MSC on Site for the resident engineer and Construction Division. Although many telephones were available, much letter writing was necessary between the two offices, whereas had we been in one office, we would have been able to get answers more directly by walking down the hall. Had that been the case, I think the communications and the honesty of all the employees would have been better. In many cases a person would tell me one thing on the telephone and a week later deny that he said it.

143 Both MSC and Corps of Engineer personnel in general were well qualified to handle most of the situations that arose; the main problem was difference in personalities rather than capabilities. The Corps of Engineers made every effort to satisfy the user wherever it could legally do so. We often held meetings to midnight with the contractors trying to satisfy NASA wishes.

337 As far as as-built drawings were concerned, it is my opinion that in most cases adequate copies were furnished to MSC. There is a difference of opinion between the Corps and MSC in this regard. Some did contain errors and some had omissions. As-builts are only as good as the inspector on the job; and our inspectors were not all of the same ability. It is my personal opinion that very minor problems were generated because of the as-builts furnished to MSC. In many cases before the Corps of Engineers finished with them, NASA had two or three additional construction contractors come in and change what existed at the time we prepared the drawings. Sometimes things that MSC would have liked to have been shown on as-builts were not because they were not required under the contract. For example, data acquisition system control cabinets in different buildings. There was no requirement for the construction contractor to do anything but hook up one side of the cabinet. Another contractor might come in and hook up the other side. Here again, Graham under a work order for NASA would come in and add other controls in that same cabinet. For an adequate set of as-builts

like some people would like to have, would have required the presence of an inspector in the building at all times. just watching the changes that were by Graham or other contractors. I believe the as-builts are primarily to show the way a building was originally constructed, where the underground lines are, and are not necessarily to show conduit or lines that can be found by removing ceiling panels or things like this. When there are follow-on contracts and the concept of a particular building is changed, there is no way for anyone to know what is above the ceiling when you start to remove it. I have been in the construction business the last 24 years both in engineering and in the field and I know of no solution that will eliminate all the problems with as-built drawings.

145 Many times MSC personnel voiced disapproval of the adequacy of the inspection performed by the Corps of Engineers and I'll have to agree with them. Many times we did not have enough personnel to adequately cover the job and other times I think that MSC imposed impossible demands on the Corps, a possible example was Bldg 32. We maintained a separate resident office for this particular building. I feel that part of this was probably necessary, in that it was such a large construction contract and many problems arose. Here again, coordinating group meetings between Facilities, construction contractors, and the Corps could have eliminated a lot of these problems and also eliminated some of the personnel.

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145 [When I went to Houston I requested some particular inspection personnel which I considered to be particularly competent, but the Fort Worth District had excess personnel in other areas with retention

rights, according to Civil Service regulations. They were sent to MSC to perform some of the work. In some cases, they were not technically qualified for some of the highly sophisticated features of the work.]

I enjoyed working at MSC the five years that I was there and I think I received a real good education, particularly in Buildings 32, 29, 14, and 49. These are the type of buildings which most people are not able to see built in a life time. I hope that some of the knowledge that I gained at MSC may be utilized in the future on similar type construction.