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Oral history interview with I. Edward Campagna
[full name of interviewee]

about Site Selection and early Center facilities
[main focus of interview]

History

Title: 1962 - Facilities, Design Branch
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1968 - (Acting) Chief, Maintenance & Operations Branch
Engineering Div.
Admin

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

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Masters 2
due to Recorder error, transcript partially reconstructed
from notes

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

Education - _____

Career Path - _____

~~account of route for~~
Topics - ~~Site~~ selection team visits ^{to} 16 cities Aug 1961;
 examples of special treatment; site evaluations;
 site acreage; relations w/ Corps of Engineers;
 selection of Brown & Root combine (6-7 companies)
 as A+D; Charles Luckman's design & presentation;
 importance of ^{problems} input from MSC scientists & engineers (esp. Tager);
 problems w/ Corps; lack of "as-built" drawings;
 re design of environmental chambers, poor inspection & construction;
 Surveillance; pre fabricated panels;
 tunnel/Continuous loop utility system; Data acquisition
 Center - air system monitoring; modular design
 Office space; lawn irrigation system; Ellington
 evaluation of initial rental buildings; parking lot design;
 (covered walkway idea dropped); ^{local} road
 improvements & Texas Highway Commission;
 problem w/ incremental funding for utility expansion

1324

Interview with I. Edward Campagna, Assistant Chief
Technical Services Division, Maintenance and Operations

(This portion of the interview failed to be transcribed because of an error in setting the tape recorder, and was reconstructed from notes):

Mr. Campagna had become familiar with the NASA program and with the ~~Manned Spacecraft Center~~ ^{SPACE TASK GROUP} through an acquaintance with Mr. Hjernevik, whose family and the Campagna family were members of the same swimming club in Fairfax County, Virginia. Mr. Hjernevik hired Mr. Campagna to be the first employee in the MSC Facilities Division that was being formed in October, 1961 to supervise the construction of a permanent site for the Center. At that time, it was thought that MSC would supervise its own construction program rather than operate through some other agency such as the Corps of Engineers or the General Services Administration. Campagna began hiring a competent staff for this purpose: Jim Bayne, Tom Conger, ~~and a man by the name of Helsum, and another~~ ^{RAY HELSEM AND GARTH SUMMERS WERE} ~~A FEW OF THE FIRST THAT WERE HIRED.~~ ^{man by the name of Sommers.}

Almost immediately after coming to work for MSC, Campagna was placed on the site selection team. Hjernevik was to have been the other MSC member, but because of illness, was replaced on the team by Marty Byrnes. Beginning about the second week of August, 1961, the team visited 16 cities, starting from Jacksonville, Florida, and ending in Palo Alto, California. In each city, the delegation was met by dignitaries representing the business and public service elements of the city. There was usually ^{PRESS AND} television coverage and all the other paraphernalia that went along with such an official reception.

118 The site selection routine was about the same in every locality visited. Usually the team would arrive in the city around five or six in the afternoon. At the airport it would be met by the Chamber of Commerce representatives and the mayor or state officials. They would then all go to a local hotel and there hold a short meeting in which the criteria and procedures to be followed by the team in examining the various sites would be explained (although such information had been furnished in advance). The following morning, there would be a ^{GENERALLY} breakfast meeting with the townspeople and afterwards there would be a visit to the proposed sites, and to the college or university located near by. The tour would usually be concluded late in the afternoon, and the Team would catch another plane to another city and the routine would start over.

118 Mr. Campagna pointed out that in those days, per diem was only twelve dollars a day, and in order to put their best foot forward, each city along the tour wanted the Team to stay at the nicest hotel in town. These were expensive and although in each case the city fathers had every intention of paying the bill for the Team's stay at the hotel, of course this was not possible, and individual Team members had to pay for his hotel accomodation out of his own pocket. Campagna pointed out that by the end of the tour, he had built up about a two-hundred fifty-dollar deficit.

118 There were some amusing incidents, in the course of the tour. In San Diego, Campagna was carrying his clothes over his shoulder in a plastic bag, and in order to make arrangements to have pictures taken,

it was suggested that the plastic bag he laid aside on one of the chairs in the terminal waiting room. The ^{CHAMBER OF COMMERCE PRESIDENT} ~~mayer~~ who was with Campagna at the time reminded him not to forget it, and it was a wise reminder as the bag contained ³ ~~a~~ suit ^{two or} ~~or two~~, three ~~or four~~ sport jackets, and several

pairs of slacks. ^{UPON RETURNING TO THE TERMINAL THEY WERE FOUND} ~~That night as they waited for their next flight, in the hotel restaurant, suddenly Campagna recalled that he had left his clothes in the terminal. He assumed they would be gone, and would have gone on without returning to the terminal, but was prevailed upon by other members of the Team to do so, and it was fortunate that he did, because the clothes were lying on the chair exactly where he left them. Campagna could not imagine this happening in a New York or a Chicago terminal.~~

118 While in Baton Rouge, Louisiana, the assistant to Governor Davis who was acting as host to the Team insisted that everyone have dinner with him at Don's Seafood House, one of the better restaurants in the South. Members of the site selection group protested there wasn't sufficient time, that they had a Eastern Airlines flight to catch and that they would surely miss it if they stopped to eat. The Governor's assistant insisted that this was no problem, as he could make arrangements for Eastern Airlines to hold the flight until they were ready. They reluctantly agreed. Upon, arriving at the restaurant, the assistant to the governor placed a call to the manager of the Baton Rouge terminal for Eastern Airlines and made his request. Campagna overheard the agitated protest from the other end of the line, but the assistant to the governor very calmly replied: perhaps you did not hear me; this is -- whatever his name was -- the assistant to the governor. He repeated

his request to hold the Eastern flight until the Site Selection Team arrived at the terminal. Again, Campagna overheard loud pleading from the other end of the line and the assistant to the governor after a short pause said I will repeat my request once more: "This is the assistant to governor Davis -- If you want to continue to have a franchise in Baton Rouge, you will hold that Eastern Airlines flight." Then he hung up. The assistant to the governor and the Site Selection Team had a leisurely dinner and forty-five minutes after the scheduled departure time of the aircraft they arrived at the terminal. They were met at the loading gate by the captain of the plane. The plane, of course, had been fully loaded for some forty-five minutes and everyone was highly irate. The Site Selection Team was considerably embarrassed by the whole episode.

118 Mr. Campagna: We wrote a report for Webb evaluating the sites we had visited and even several that we did not visit, but members of the Team were familiar with, such as Langley Field. I think we submitted summaries on twenty-six sites in all. Then we came back to Washington and gave Mr. Webb and Dr. Dryden our report which they evaluated and used in the selection of Houston several weeks later.

118 Up to this time we didn't know where we were going. We just knew we were going some place. Most people believed we would end up in Tampa, Florida or Houston, Texas. McDill Air Force Base, near Tampa was a strong contender for the site. One of the things that elated me with the selection of Houston over a retired Air Force Base or an old Army camp was the fact that we would be starting a center with new equipment and new concepts and not be saddled with old utility systems and worn-out equipment that really wasn't suited to a mission like ours.

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141

The original site selection was for 1020 acres of land that had been given to Rice University by the Humble Oil Company. It was part of a 36,000 acre tract that included the old West Ranch. Rice offered us this 1020 acres gratis as a site for the Center. However, after we had a chance to examine the configuration of the land, we discovered that only 240- odd feet fronted on FM 528. We realized even then that eventually we would have a minimum of 4000 people at the Center, and in fact, our design criteria, as I recall, was based on that figure. We realized that we could not get this number of people on and off the Site in an expeditious manner with only 240- foot of road frontage. This was about the time that Leo Zbanek came onboard as head of the Facility Division, and as one of his first responsibilities he prepared an estimate of our needs (with Wes Hjernevik and Marty Byrnes). Webb agreed that we should add whatever was needed to our real estate holdings. We added 600 acres, most of which was along FM 528, and which gave us the access to both FM 528 and back roads leading into what is now Clear Lake City. This additional increment was purchased from Rice University. George Brown, then the president on the board of regents of Rice University, ^{ARRANGED FOR} ~~sold us~~ the land at a fee the government thought was reasonable. The land costs in the Clear Lake were so high that the government had a problem paying the going price, and I understand Brown had to trade land owned by Rice University in downtown Houston for the land out here.

Meanwhile, in September, Mr. Webb announced that the Corps of Engineers would become our construction agency. Up to this time, we were still assuming that we would do our own construction. I made the first

142
contact with the Corps. I went down to Fort Worth with Jim Bayne and we made working arrangements with them. Colonel West was then chief of the Fort Worth district office of the Corps. My own background was with the Corps of Engineers at Fort Belvoir in the Research and Development Lab, and later in the office of the Chief of Corps in Washington, D. C. So, I had a good knowledge of how the Corps operated. This helped in the negotiations.

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Shortly, thereafter, when funds became available and it was announced that ^{65.54} ~~fifty~~ million dollars ^{of the FY 1962 NASA appropriation} would be available for construction at Houston, the Corps selected the architect-engineers. It was decided, that we should be consultants to the Corps' A&D Selection Board rather than members of it.

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[We had a feeling that the selection could become a political football, and we didn't want to get involved in it. We let the Corps bear the brunt of any politics. We felt that we had veto rights and we would not give up anything in the process.]

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The Corps selected 20 ^{AIE Concerns} ~~companies~~ as candidates to be considered for this job, and Brown and Root was one of the twenty. [However, when we knocked the list down to fifteen, they were not included in the first fifteen, and the Corps got word from the Chief's office in Washington to include Brown and Root in the fifteen. As I recall, the next step was down to about eight and again Brown and Root failed to make the list. But again the Corps Headquarters asked that Brown & Root be added. When we got down to five, their name was missing again and again it was asked to be put in -- just to keep everybody happy. We had a feeling then that

this was just a gesture, but when the Corps made the selection, it was Brown and Root. What the documentation shows in the Corps files -- I have no idea.] Anyway, the Brown and Root combine was made up of about six or seven different companies.

146 Charles Luckman developed with help from us and the Corps the architectural vocabulary and the master plan for the Site. The night before we gave the initial presentation to Dr. Gilruth at Langley Field (as I recall this was about the 5th of January of 1962), Luckman flew to Langley Field in his private plane. He had not seen much of that design job, yet between 10:00 and 4:00 the following morning his chief project engineer briefed him on the details of the design. When he got up in front of Gilruth and the rest of us (I guess there were fifty or seventy-five in the room), and gave that pitch, you would have sworn he drew every line on the paper. He is a real salesman -- high-powered, very forceful, and explicit on details. The Luckman technique was very interesting. His technique was to pick out little dimensions and little details like "now a hundred and eight feet back from this corner we are gonna do this because it will create this effect", and it gave the impression to everyone except Bayne, Zbanek, and me that this guy had a real strong influence on the design which I think really was not the case. He did such a selling job and almost demanded Dr. Gilruth make a decision on the spot so that we could move ahead. Dr. Gilruth gave him his approval immediately. Now this is not to say that we didn't go back and make substantial changes in his presentation. In fact, as we got farther down the road a month or so later we discovered that the overall

architectural vocabulary was one we could not afford and had to cut it back significantly to fit the budget.

149
148
The Facilities Division didn't move to Houston until early January, 1962. There were just a few of us at that time. I stayed at Langley Field to develop design criteria while Jim Bayne and Leo Zbanek worked in Houston with the A&E. The biggest job we had was to get the MSG scientists and engineers to tell us what they wanted. I guess during the first three months before the Corps even got into the act, Jim Bayne and I held almost daily meetings with Faget's staff (Faget was the key man at Langley) Chris Critzos, Chamberlin, and a few others. Our problem was trying to get them to define what kind of facilities they needed, and of course, they didn't know except in general terms. We were getting nowhere until finally we (Bayne, Zbanek and I) tried a new approach. We would listen to them, and then come up with little sketches which they could pick to pieces. This was the technique we used all during the design, and if there were any goofs in the design, it was basically due to this, although we really didn't make many. The overall design has proven to be pretty functional and quite good from the maintenance and operations standpoint. But even while individual facilities were under construction we made significant changes in design because of new concepts developed as we moved farther into the program, and because new branch chiefs and division chief were being appointed and they wanted different operational configurations than their predecessors did. It was one big headache -- it wasn't like coming into an established agency where every-
one knew what ~~they had to do~~ ^{their job was}.

145 Jim Bayne and I established guidelines for the Corps' use in our first meeting with them at Fort Worth. [Later we found that they didn't live up to the guidelines, and we had difficulty in controlling their actions. They would make unilateral decisions which would affect us, and we would not find out until it was too late. This was the history of our relationship with the Corps. We kept as close a watch on them as we could, but since they were the contracting officer, we never knew exactly what they were doing at particular time. For example, we had set up a change order board. To effect the change order, the Corps had to have the agreement of NASA. We found the Corps often failed to adhere to this procedure.]

145 [I guess the biggest problem we had with the Corps was directly attributable to the fact that they were not really building-oriented. The Corps' strength lies in dam construction and other major public works. Their performance in building construction was far from outstanding. Another problem that concerned us was the speed of construction. I felt that we were sometimes going too fast and not reviewing the drawing sufficiently. However, if we had slowed down we wouldn't have gotten the Center up in the time we did, so I guess we had a trade-off here. Some of the things that we missed during design review, however, we're paying for now. During construction, even with a hundred of their men on the site, the Corps really wasn't giving us the construction surveillance that we were paying for. One area, that they fell down in particular, was as-built drawings. As-built drawings to the Corps of Engineers were simply construction drawings that are updated. In our minds, an

as-built drawing is really a representation of what is actually in place and that we failed to get. For most of our facilities we do not have accurate as-built drawings, and we have spent a considerable amount of money making them since the Corps left. We have had to spend around a quarter of a million dollars in building 32 alone for as-built drawings.]

237
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[In my estimation, the biggest boo-boo the Corps made on Site was the design of the environmental chambers in Building 32. This chamber, as you know, began deforming while under vacuum integrity test. We immediately stopped the test and went into a full scale investigation. Here, again, the Corps left much to be desired in their approach to a solution. They and the A&E wanted to start adding steel in a haphazard manner. We stopped that right in its tracks. We would not allow any modification or changes to the chamber until each new design concept was checked out and verified. At our insistance the Corps brought in a structural specialist E. P. Povolny from the University of California at Berkely, a Dr. ~~Papoff~~. I guess we ~~can find out how to spell his name some place~~. MSC made two models of the chamber in our shops, and actually did a vacuum test on one to show that the failure did conform to the structural inadequacy. The model deformed exactly as the chamber ^{had} ~~did~~. At the conclusion of the redesign, the second model was built ~~and tested~~ exactly as the new configuration ^{the tests} and ^{the final} it also predicted deflections very closely. At the same time, NASA ^{Simpson, Gumpertz & Heger Inc., Consulting Engineers of Cambridge, Mass.} hired ~~a Boston engineering firm~~ to make a mathematical model of the chamber. To our knowledge this was the first time this has been done on a structural vessel. It was a breakthrough in structural design, and although I believe this study cost us about seventy thousand dollars, it again predicted the

deflections of the new chamber very closely. But the significant thing is that the models predicted the new deflection closer than either the Popoff study or the mathematical model and were the cheapest. A NASA team was developed which worked very closely with the Corps and the A&E in the redesign of this chamber and I frankly feel that without this team and without the support of the Structures and Mechanics Division that the redesign never would have been satisfactory. ^{Kier} Strass, representing S and MD, and I, representing Facilities Division headed up this team. In the redesign of the chamber we added roughly a million pounds of steel to it. The final tests were very successful. We also redesigned Chamber B as we found structural inadequacies in its design.] ~~Luckily we had not tested that yet.~~

237
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[This problem reflects the Corps attitude on design: we'll fix it by throwing steel at it attitude whereas NASA wanted a sound engineering approach to the problem. This has been pretty much the story of the Corps' attitude at the Center. I think the inspection and construction surveillance was particularly poor, considering the number of people on the site. I think the record will show that the Corps was a pretty expensive construction agency.]

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[redacted]
[redacted]
[redacted] When we decided to go to the more modern design concepts, -- mainly glass and lots of it, we realized that a bad hurricane could conceivably cause considerable damage. We were especially aware of hurricane damage because Carla happened right after the Site was selected.

We made extensive aerial studies of the effects of Carla, and we found that the high water level was thirteen feet above ~~normal~~ ^{mean high water}, and that elevation corresponded with the lowest spot on our property.

146 The design concept of the prefabricated building panel, I think, was a excellent one. We have a beautiful architectural vocabulary and the cost has been reasonable. As an illustration, the cost of Building 2 was considerably lower than the cost of the Humble Building. It's difficult to compare costs because the Humble Building has its own utility system ^s and the ~~air conditioning equipment is~~ ^{cost} charged against the building, whereas we prorate the cost of our Center support service.

146 Also the use of utilidors or tunnel system to carry utility service to most of the buildings on the site was a soundly conceived technique, as it is a continuous loop system. If a steam or chilled water line breaks, we have automatic valves that can be operated to assure utility services to all facilities from the other side of the loop.

148 One of the major breakthroughs in design was the installation of the data acquisition center ^{DAC} in Building 24. This system continually scans and logs the heating and air conditioning pumps, fans and so forth in the Center ~~ma~~ll area. Through the use of this system, we require only three operators on the Site. We estimate that ^{without the DAC} we would have to have around seventy-five operators, and would still not have the reliability that we have. For instance, if a fan has gone off in the office area, we will generally know of this condition twenty or thirty minutes before the first phone call comes in reporting discomfort. This system also

338-2
 monitors electrical valves and conditions in the tunnel. Sensors in the tunnel read the temperature, so if a steam line does ^{Rupture,} break, the operator ^{immediately} (knows ~~that~~ ^{AND} he can ^{BLOCK} ~~immediately~~ close off the system ^{AT} where the break ~~is~~. This is the first time that a system of this type has been installed on such a large scale.

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 Another significant design concept that we have incorporated is the ability to change internal partitioning in office space quickly and cheaply. Modular type design has allowed us to do this. Office modification -- of which we've had more than anticipated -- has cost us far less than one would expect, simply because of the flexibility of the system. The underground communications, ductwork, communications, electricity, and so forth in the floor^s have also increased our ability to move people and modify office space.

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14

Continuation of Interview with Edward Campagna

337
338-2
Mr. Campagna: I think the lawn irrigation system which incidently was not recommended to us by the A and E or the Corps, has turned out to be extremely practical. It has made it possible to keep our grounds in a satisfactory condition at reasonable cost.

172
From the outset we were aware that we were going to have to use Ellington Air Force Base both as an interim and a long-term facility, so the Site Survey Team took a real hard look at it. I think Ellington has been our salvation as to space. Most of the buildings at Ellington have been renovated for approximately six dollars a square foot. We've gotten this money back over and over again in the number of years we've been here. The buildings have been very adequate from the standpoint of comfort, what with the air conditioning and the panelling we put in most of them. Our biggest problem with Ellington Field has been maintenance. The buildings were not designed for air conditioning. Termite damage is extensive and maintenance has been fairly high, but still we have had cheap space.

172
Our big problem was finding space to move people into quickly. Marty Byrnes, who was the Center manager at the time, acquired a large number of rental buildings for immediate occupancy. The Facilities Division inspected them and offered advice on whether or not we should rent them. We also supervised modifications to them. The old Lane Wells Building, for instance, was modified considerably to take the laboratory equipment we had to put in it. The Canada Dry Building was a very good shop-type facility but we had to increase electrical power in it. It served very well as a machine shop. The Rich Building also

needed extensive modifications. We had some of our computers in it, and its air conditioning system (which incidentally was a product of the Rich Company) was inadequate. We had frequent problems with it and even obtained two large sixty-ton portable air conditioners to

287-2

service the computers. Restoration of these buildings back to the original owners became quite a problem because we had to make the owners happy with the way the building was when we turned it back to them.

In some cases we had to modify the buildings back to the original configuration depending on their owner's desires and the terms of the lease. In all cases we tried to move out as cheaply as possible. One of the problems in the Farnsworth Chambers Building was the restoration of the floors to their initial condition. The floors had always been inadequate, as the tile came loose in most of the building, and eventually it became necessary to cover it with carpeting in at least the executive offices. When we got ready to leave, we were about to take up the carpeting, but the floors were in such horrible condition that we knew some adjustment would have to be made. The carpeting itself, also was about worn out from our occupancy and wouldn't have been of any significant value to us in the future. However, we negotiated for almost a day with ^{the owner,} a Mr. York, and we finally got him to accept the carpeting in lieu of extensive repairs to the floor. Actually, the reason for the trouble with the tile was inherent in the poor construction of the building. The slab was moist ^{most of} ~~all~~ the time, which caused the adhesive under the tile to break loose. We finally made the owner ~~pay for~~ ^{to} ventilating the slab. The restoration of all the buildings was a major problem because we were limited as to the amount of money we could spend under the Economy Act,

172
211

which stipulated that only a certain percentage of the rental fee could be put into modifications of the building. Extensive reports had to be made to satisfy the GAO that we had lived within the provisions of the Economy Act.

The Franklin Apartments were a constant problem in that the air conditioning, which was probably barely adequate for ^{AND} apartments [^] was grossly inadequate when changed to office space and the number of occupants and light loads increased. Extensive engineering studies by our Facilities Division staff were required to convince the owners of these problems. The gas-operated air conditioning system in the complex was not operating in a satisfactory manner, and at our insistence, the owner got ~~the~~ ^{THE} installer to make it function correctly. We also got him to ventilate ceilings and attic space, alter duct work and put sun shields on strategic windows to cut down heat loads. Maintenance was high and breakdowns frequent.

The University of Houston TV Station, which was old, required extensive modifications to convert it to office and computer space. The initial computers obtained for MSC by Eugene Brock's division were installed here. Here also, we had to do extensive modifications to the air conditioning system. In this case, however, we utilized the equipment that was already there for the most part and saved the government a considerable amount of money. We did supplement this equipment, as I recall, with 7-1/2- and 10-ton package air conditioners which were later used at the Houston Site or at White Sands. We always tried to keep in mind that in modifying the air conditioning at an interim facility we should be able to reuse the air conditioning units. We

also tried to keep this principle in mind in other areas, such as computer flooring. On leaving our interim sites we removed equipment that belonged to us that we could reuse. However, if it cost us more to remove it than it was worth, in most cases we left it in place in return for concessions on the part of the owners.

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The Peachy Building on Long Drive was a two-story building occupied by elements of both the Facilities Division and PAO. It leaked badly, ^{during RAIN storms} had air conditioning and electrical problems, and about every other kind of problem that you could ^{IMAGINE.} ~~discover~~. The Facilities Division modified this structure extensively to make it livable for the short time we were there.

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We also had considerable air conditioning problems in Houston Petroleum Center. Houston commercial space design is pretty inadequate, really. It seems like most of the space is designed for resale. Somebody puts it up in a hurry and plans to sell it off and the poor guy who buys it the second time and wants to keep it for investment is the one left holding the bag. The Houston Petroleum Center and the old Office City complex on the Gulf Freeway had the same kind of problems. Air conditioning and electrical systems were substandard and we even encountered poor construction that ^{CAUSED} ~~cost~~ us a lot of grief.

146
I think the most significant aspect in the design of the permanent site is that it made our operational and maintenance costs minimal. In discussing common problems with other NASA Centers we find that maintenance costs are about the same everywhere, but I believe the other Centers lack the ability to respond to maintenance problems as quickly as we, because the data acquisition center has given us a degree

of reliability here that no other Center has. It is quite evident that the other centers envy us in having such a tool. After extensive study of our system the Marshall Space Flight Center installed a similar type even though it is on an old army base. They found that it paid off, ^{ALSO,}

146 From the very first presentation made by Luckman to Gilruth it was recommended that the parking lots be located both in outlying areas and contiguous to the buildings they served, and it was agreed at that time that this arrangement would create a more pleasant environment from an architectural standpoint. It is comparable to a college campus layout, where parking lots meet legitimate needs but don't ^{destroy} ~~mess up~~ the ~~whole~~ architectural environment. Generally I think this approach has been satisfactory. Some of our personnel are obliged to walk a block or more to their building and these personnel complain about it, but if they had to experience the walking that people have to do in Washington, ^{D.C.} I think they would be more appreciative of what we have here. At one time we discussed covered walkways between buildings, in lieu of the tunnel system. It was felt that the tunnels could be above ground and utilities run above the covered walkways. The cost would not be considerably more, and may even have been cheaper. However, we felt that Congress would think that we were gilding the lily, and the concept was abandoned. It would have been very unusual, as it would have afforded air conditioned comfort for pedestrians, during their movement between major facilities.

329 At the outset we used Goddard Space Flight Center as a guide in determining parking space requirements. There one person per space was the rule of thumb. We had some difficulty supporting this level of requirement. Also we had a problem in not being able to convey the

impact of the parking required by contractor personnel — both construction contractor and support contractor. This has been one of our major problems since the Center opened. Parking in some areas is still extremely critical.

148-1
Immediately after the selection of Houston as the site of the Manned Spacecraft Center, Mr. Zbanek, Mr. Hjernevik, and I indicated to the local community groups that the road network in the vicinity of the Site would have to be considerably modified to meet the needs of the Center. It's quite pleasing to note that almost immediately action was taken to improve FM 528 from an old two-lane road to a modern 4-lane highway. The Texas Highway Commission managed to react surprisingly quickly. By the time erection of Site facilities began, road construction was well underway. I think it is ^{typical of} ~~a~~ commentary on the excellent support that we've received from the county, state, and the city of Houston in building the Center. Because of limited funds in the initial 1962 budget, the number of trees and shrubs planted was kept to a minimum.

146
One place that we seemly have gilded the lily — the Center mall with its three lagoons — was a result of the natural terrain limitations. The land here is so flat, has no character at all — that some degree of landscaping was necessary. It was felt that the lagoons and the low, small hills ^{the} contiguous to them would add atmosphere of a college campus intended and planned in our design. At one time we considered using the lagoons as cooling ponds for the central heating and cooling plant. However, this was not feasible from an engineering standpoint; it ~~was~~ ^{was} costly and inadequate for the amount of cooling that is necessary.

One of the major problems we encountered in construction of the Center was the initial budget of sixty million dollars, which was just a start for the Center. We knew that the initial design of the heating and cooling plant would have to be expanded. ~~Yet we couldn't install more capacity than required.~~ ^{However,} We were only allowed to install the boilers and chillers and accessory equipment necessary to service the buildings approved by the budget. Consequently, ^{EACH YEAR} ~~before we were here~~ ~~two years, three~~ additions had to be made to the heating and cooling plant. ^{to support subsequent budgets} As more facilities are added, the cooling and heating system again will have to be expanded. This is an uneconomical approach but but it's the only one that's feasible under the present methods of funds disbursement.

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148