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Oral history interview with Jack A. Kinzler
[full name of interviewee]

about Technical Services Div; scale models, testing, support, staffing, training.
[main focus of interview]

Title: 1962 - Technical Services Division, MSC
[interviewee's current and/or former title and affiliation]
1968 - Chief, Technical Services Div, Admin

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 34; # tapes 2]

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

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Education - _____

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Career Path - 1941 - Langley Research Center

1959 - Space Task Group

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Topics - Support Shop planning for STG; initial plans to build STG facilities at Langley, then (GSFC) Goddard; ~~building~~ help in estab. tech. services organiz. for Cape Kennedy; Big Joe ~~Project Coop~~ at ~~Beta~~ Langley + Lewis; TechSer. transfers to Houston; model testing for escape rocket motor; mobile field support for Big Joe; centralized craft technician support vs. separate division ~~organization~~ branches; MSC central tech service organization (staffing + facilities); low ratio (less than 5%) of craft-technicians to total MSC employees; 1961 - pcounting & photos of Houston-Clear Lake site by air; temporary quarters + transfer from Virginia; early work in Corvalda Dry bunding; fullscale Lunar Module mockup; Move to Ellington AFB; Space capsule testing; tech service facilities at MSC; Film Test Branch; Little Joe launch assistance White Sands; manufacturing surveillance; scale model Space Chamber (for research) corrective measures (SLA 5 SELS)

Correcting Chamber A liquid nitrogen joint;
Work on Radiator Intensity Measuring System (RIMS);
emphasis on mission oriented services;
Civil service + Contractor staff ratios + responsibilities; planning
and scheduling workload + personnel; community
service work; Junior Achievement program;
NSC Apprentice Technical Institute; nationwide decline
in skilled craft technicians

(1358)

January 17, 1968

Jack,

The transcript of your interview, edited to remove extraneous material, is attached.

If you will, please read the statement and mark those sentences with brackets [ ] that you would not want alluded to in a Center history for reasons of embarrassment to an individual or the Center. As I mentioned during our recording session, this interview is to be part of the source material for the history, and it is doubtful that I will quote from it verbatim. Therefore, please don't worry about a sentence here or there which might not be as polished as would be desirable were it to receive public scrutiny.

If you want to add information feel free to do so. Just tack it on at the end of the statement, unless you prefer that it be inserted into the text.

After you return the transcript to me, I'll send you a copy for your personal file.

Thanks,

BOR

The entire transcript looks OK to me and I approve use of any or all of it as you see fit. I hope our Division receives a fair measure in the Center history since we are one of the few that got in on the "ground floor" so to speak. Jack A Kinzler

Interview with Jack Kinzler

10/31/67

In the fall of 1959-- I believe that's the right year-- I was asked by my supervisor at the Langley Center if I would consider transferring to this new group of NASA people who were planning to launch a program to get a man into space by rocket propelled space-craft. Would I be interested in going over and assisting with the development of a craft support group? By this time I had 18 years service in the Langley Research Center, and I think my selection was based on the broadness of my career, which included a 4-year apprenticeship program at Langley following graduation from high school, and some University of Virginia night extension courses and much on the job training. I was assistant supervisor of the machine shop at Langley but my significant experience was as supervisor of the initial installation and shakedown phase of most of the major facilities at Langley. This background seemed to fit the need that Dr. Gilruth had in mind--a person who knew something about establishing base support shops for R&D work and also had experience with test facilities that depend upon shop service support to operate properly.

I accepted the offer to join Dr. Gilruth's staff. I began planning a suitable lay-out of shop buildings, generating machine tool lists and budgets to acquire these machine tools, planning a Civil Service staffing alignment to match the proposed buildings and equipment.

I was the only technical services employee in Space Task Group for some three or four months, after which I began acquiring key personnel to further develop this proposed organization. Some of the first that I acquired were ex-Langley Research Center high level shop employees who had not yet moved into management positions; some were first line supervisors. The rationale I used in recruiting my original group of people was to acquire experienced men, hopefully one each in all the environments that I thought we would need to carry out our support services in the future. As a result of this approach, I acquired men with a background in machine shop, sheetmetal, electronics, woodworking and plastics and then a few people of highly sophisticated mechanic or specialist type capable of working with pyrotechnics, and the aircraft mechanic type associated with both electrical and mechanical work. This initial development of the Technical Services Division then resulted in approximately 10 to 12 people being on board perhaps at the end of the first of the year.

While we were starting from the very beginning with a plan to man and operate a central technical services organization it was unclear where this organization might be located geographically or how large it might be. The reason for this was simply that we were starting Project Mercury, and weren't quite sure of what requirements would really be until we got further into the program. An example of this uncertainty was the early plan to use the Langley Research Center locale with additional buildings as one way of handling the increased requirements of the manned spacecraft program. Our first thoughts were to put some

buildings together in an area at Langley Field where we might be able to coordinate our new work with existing work and possibly have a smooth transition with limited impact on personnel.

Shortly after this first concept phased out, there was a firm plan to locate the Space Task Group at a new center in Greenbelt, Maryland, later to be known as the Goddard Space Flight Center. This decision did have ramifications on my division planning. I was asked by Messrs Donlan and Gilruth if I would participate with Phil Miller formerly of the Lewis Laboratory, in the advanced planning for a space center to be built at Greenbelt. I accepted this request and began a period of about three to five months in commuting between temporary facilities at Greenbelt and the Langley Center, coming home on weekends. I took my original data on buildings, equipment and personnel staffing as a guideline and laid out what we thought would be our facilities at Greenbelt.

Some of our tech services employees, Mr. McGraw who is my present Assistant Division Chief, and several other men joined me from Langley. Fred Taub, Jim Rice, Oren ~~Willby~~ WoBig, and Charlie Tucker. Each of these men was the type of craftsman that had 15 to 20 years service in the government, knew a great deal about central technical services associated with R&D work, and all were very well qualified to assist me in the development of a shop organization. As a matter of precedent, most of the old Langley Center's shops organizations were manned by career Civil Service shop people with some professional people in the top echelons. The long term Civil Service people understand the skills required and have close understanding and relationship with the craft blue collar-type people

that they have to deal with.

After about three or four months of this initial effort to build a facility in the Greenbelt area, I began to have reservations about transferring North. In addition, I had some uncertainty about the future location of the Space Task Group. I was offered the assignment as Chief of the Technical Services organization at the new Goddard Space Flight Center, but it was not quite clear whether this would be the final home of Project Mercury. I turned down the offer for personal reasons, simply preferring to live either in the Cape area or any other area that might be South of Washington. As a consequence of my personal decision, I stayed with Space Task Group. Each of my key personnel were likewise made job offers to transfer to Goddard. Most of them were more shop oriented than I and they saw the benefit of moving to Greenbelt. As a result, I lost half the personnel I had acquired to Goddard.

At this point my interests were more heavily oriented toward shakedown tests on the first Mercury vehicle, known as Big Joe. This was a key point then in my personal career--the decision to stay with the Mercury Program rather than simply identifying myself with a central shop organization.

Even though my key subordinates did transfer into the Goddard organization, after we firmed up our spacecraft center plan for the Houston, Texas area, I was able to reacquire Mr. David McGraw from Goddard on a lateral transfer. He rejoined me in Houstin in 1962 or 3, I did not reacquire any of the other personnel from the Goddard area and they are still there today performing commendably, I am sure.

In addition to starting the technical services organization at Goddard, we established a base of operations at Cape Kennedy (then Cape Canaveral). I worked with G. Merritt Preston, who came over to the Space Task Group from the Lewis Research Lab in Cleveland. Pres and myself conducted a selection process, interviewing and looking at 201 files of craft employees from Lewis and Langley, and chose the people who formed the nucleus of a tech service organization to assist in the launch preparation at Cape Canaveral. Frank Cryden and Joe Bobeck were acquired from the Lewis Lab; and became key inspectors at the Cape, and Jesse Fraser and Al Conners came over from Langley to work in areas as electronics and parachute assembly and packing. As this group was transferred to the Cape area, I assumed the additional responsibility of working up a small list of basic shop equipment and a nominal plan for a very small base support shop. Bear in mind our intent was not to get into any manufacturing activity at the Cape, but to simply provide a small quick response for shop facilities. We handled the buying of this equipment from the Langley Space Task Group through Langley Research Center's procurement department. Things were pretty hectic in those early days, because we were using other people's services to support our needs and we had to compete for attention. Once we got our craft type people established at Cape Kennedy, we began to participate in direct support of the first spacecraft launched by the Space Task Group. This was the Big Joe effort.

At this point, as chief of the technical services organization,

I had several responsibilities. One was to plan and organize for the long haul--people, buildings, equipment. The other was to support Space Task Group efforts directed toward getting up a spacecraft that we could get data from. In the beginning, while we were housed at Langley Field, I made arrangements to get shop services from the Langley Research Center on a work order call basis, since we had just a handful of people and very limited equipment in the Space Task Group area. During this period, there was test activity scheduled at Wallops Island. In addition, we manufactured at the Lewis Langley Shops, the first Cape Kennedy spacecraft launched. I used my staff to coordinate some of the planning and to manage acquisition of this shop built spacecraft (known as Big Joe). We commuted between Lewis and Langley. Big Joe was built with the top half, the recovery system, the parachute system, and all the recovery aids and the structure to hold them by the Langley staff while the lower section of Big Joe, the telemetry, tape recorders, and the flight data acquisition system was designed, built, and installed by the Lewis Lab. So we had an interface where we had to mate the upper and lower sections of the Big Joe and then we ran through qualification and acceptance testing of the combined vehicle. To do this, I had some personnel responsible for the recovery system, the parachutes, the beacons, and the Langley portion of the spacecraft, and similarily Scott Simpkinson had responsibility with his Lewis personnel for tape recorders, telemetry, etc. Once we had assembled Big Joe and proof tested it, our next move was to transfer this vehicle to Cape Kennedy. We knew this event was coming so we started our staffing

of the organization at the Cape as I mentioned earlier. I wore the hat of Crew Chief for a period and took three or four men--Jesse Fraser, Al Conners, Leo , to the Cape and joined with people like Frank CRICHTON and the Lewis lab types as a composite team of Civil Servants who had the responsibility to shakedown and preflight test. The final responsibility was to serve as part of the launch pad group. This flight was an Atlas, and we had an interface with Convair people who, of course, managed the Atlas portion. We served in a group of I guess 30 or 40 Civil Service people who constituted the Big Joe team and they checked the spacecraft out in Hangar S, got it ready, drove it out to the pad, erected it on top of the Atlas, and then participated all the way through the countdown as a regular crew. ~~Lewis Lab~~ This work was later transferred to McDonnell on a later flight. The cooperation was excellent between Langley and Lewis Lab during this period. There was some difficulty of course in recruiting people as the centers hated to lose them. There was also some difficulty occasionally in getting access to test facilities. Nevertheless, we generally had excellent support, and assistance from both Langley and the Lewis Laboratory. Occasionally I was reminded to not prosolyte people. Everyone likes to keep their good key personnel, and when I was given this reminder I always made it clear that my policy was to let people contact me and ask for the opportunity to be interviewed. I did not seek out people. I guess the only exception to this was some of the men I had worked with closely for years. I asked about a half a dozen of them to come with me. We transferred approximately 60

personnel when we moved to Houston area and of that 60, there were perhaps 5 or 6 whom I had asked to come with me. The rest made themselves known and were interviewed in a routine fashion.

At the Cape the Tech Services Division directly participated in the Big Joe Program. We offered many suggestions and modifications to the spacecraft to make it more ready for flight. For example, the escape tower associated with Project Mercury was the idea of Dr. Max Faget. He felt that using a rocket motor on top of the spacecraft would provide a safe means to get the spacecraft away from the booster on the pad or even in the liftoff phase in the event of a possible catastrophic failure. Since the rocket motor would be above the spacecraft, it was apparent that some work had to be done on the development of the alignment of the exit nozzle so that exhaust jets would not impinge on the spacecraft proper and jeopardize its integrity. I represented technical services in this typical solution of a technical problem. I borrowed a drawing board and got a sketch from Max. He suggested a 1/4 scale model centered around a standard $3\frac{1}{4}$ inch motor that was used at Wallops extensively. He suggested that he would appreciate it if I would design some models and have them manufactured in the Langley shops, assembled and transported to Wallops. Working with one of his test engineers, we conducted a little preliminary program to identify the proper angle for the exhaust nozzles on this escape rocket motor. Three weeks after we received this sketch I drew up a scale model that matched the proposed flight configuration.

I arranged for the Langley shops to assemble six of these models quickly. Using the technique of scatter shot, we had one model made with a ten degree angle cant, one with 15, one with 20, 25, 30, etc. In effect, the idea was to launch a successive series of scale models, rocket powered and by a means of high speed photography, track the impingement plume of the rocket exhaust upon the spacecraft. This program was concluded in three weeks, including launchings and data gathering. It was considered significant enough to finalize the proper angle of the exhaust plume, with respect to the Mercury spacecraft proper. This is just one of the many assignments that were carried out in the early days of Project Mercury by myself and personnel that I had in the Technical Services Division at that time. We participated in other Wallops Island operations. For example we had recovery personnel who would go out on the boat, gather up the spacecraft, the parachutes, etc., after the various Wallops shots (the Little Joe Program). I guess you could say that on a local basis, before we moved out of the Langley area, my organization provided most of the mobile field support associated with Little Joe shots, local air drops, etc. This was a natural thing at that time since we had no base shop and were mainly involved in early experiments to develop a basis for a specification for Project Mercury.

Since I had been hired on to acquire a support craft organization, in the beginning we acquired the people I described previously--shop type people--but there were some other elements needed by the larger Space Task Group organization such as flight systems technicians,

chamber technicians, and aeromed technicians. We needed a fairly broad-based electronics technician group to assist in various laboratory activities. As a consequence, my early organization contained a group I believe was known as the Life Support Branch, and consisted of suit technicians like Joe Schmidt and Harry Stewart, who today is an assistant to Dick Johnston. These personnel I recruited from the military. Many of them were retired naval personnel who had experience with survival equipment, flight suits and vacuum chamber testing with human occupants. This group worked with Dr. Stanley White in the early days to build simulation devices, equip dressing rooms, fit astronauts spacesuits, etc. As Dr. White's organization grew in size, he felt that the craft technician group associated with my division was in reality the nucleus of an operation that he was responsible for and he made the recommendation to higher management that we mass transfer the Crew Systems Support Group that was in my division over to his division. This recommendation was paralleled by a similar one to transfer those electronic technicians who spent a good deal of their time in selective divisions. I opposed these trends as I felt the best arrangement was to provide personnel from a centralized area to carry out support services through the Center, and in selective cases even provide resident technician and craft personnel. Each specific element in an R&D organization tends to want to be self sufficient and sooner or later attempts to acquire these craft technician types on a fulltime basis. I tended to yield to such requests when it was apparent that the larger organization indeed justified an independent direct craft or technician support force.

At the same time, in the interest of Dr. Gilruth's master plan and my own interests I attempted to prevent my personnel from being released to anybody who asked for them. I lost the electronic technician support groups, and I similarly lost the crew systems technicians. Although we released the electronic technicians and the crew systems technicians from our division for the users based on their becoming significant sized organizations, I did retain an electronic branch which continues to provide central electronic fabrication and repair service. We do however, have counterpart organizations throughout the Center where Civil Service electronic technicians are in residence and work on selected projects.

Insofar as tech services staffing concepts were concerned we laid out what we considered nominally sized buildings and equipment floor plans, and finally considered the staffing required. To arrive at a staffing figure we looked at some of the older centers like Langley, Lewis, and Ames. We recognized the role of the Manned Spacecraft Center would be somewhat different in that it is largely program management oriented but we also recognized there was a series of peripheral test facilities that would require shop services. So our staffing initially envisioned about 300 personnel for the central Tech Services organization and we assumed that the various laboratories would likewise staff with perhaps 20 to 50 technicians depending upon their requirements. As it turned out, our staffing allocations were held back in the early years since we were not in residence, did not have our facilities available to us, and were instead used to satisfy

the immediate needs of the Mercury, Gemini, and Apollo program offices, associated procurement support and things of this nature. The consequence was that when we got to the Houston area and began to acquire our facilities, we had begun to experience a staffing squeeze, and it was no longer possible to acquire the staff that our earlier requirements dictated. Some judgment had to be made in regard to staffing trade-offs and a typical one was as follows: I originally had in mind a maintenance branch that would have Civil Service people conducting maintenance work similar to the craft people doing shop manufacturing. When we saw the staffing ceiling was becoming a limiting factor, we reassigned this maintenance and operations type activity. I guess you could say we relagated it to a service suitable for contractual support. The result was that the nucleus of 8 or 10 people that I had for maintenance services, were required to change from direct maintenance to indirect maintenance through the management of support service contracts. I think we made a good management decision at the time and I feel that there is a benefit from having a consolidated total Civil Service operation. However, there is also the real problem of providing or buying services that are considered secondary in nature to the primary role of the Center which is to manage and develop flight spacecraft.

I also had to revise my organization in many other ways. For example my planning and scheduling office relied on commercial job shop management in addition to planning and scheduling in-house work.

Over the years we have transferred perhaps five or six additional men into the planning and scheduling office to assist us in placing contract work in the Houston area. This is the direct result of this change in concept on staffing. We have nevertheless maintained a nucleus of skilled craftsmen in the Manned Spacecraft Center shops. We feel this is an absolute need. We were willing to release maintenance and other functions to service contracts, but we maintain that there is no way to buy the equivalent of 20 years of Civil Service experience in craftsmen. We have never found a suitable alternative to the team of engineer-technician, both with much government and spacecraft type experience to develop and produce with limited information a needed article for spaceflight testing.

There's one other point worth mentioning. We did some statistical analysis on the proposition of craft groups to the total of engineering personnel or the total Center strength. We found that at Langley the craft area represented close to 33% of all Center employees. At the Lewis Laboratory approximately 17% of the total staff was craftsmen and technicians. At other older Centers the proportion was probably 20 to 30%. At the Manned Spacecraft Center, the highest proportion of the Center strength that I have ever achieved is approximately 5%. Now what this points up, is that we've had to operate at a lower than appropriate ratio of craft and technician personnel to the total Center strength. If we were to be asked what our target would be for this Center, our answer would be around 10 to 12%. We would like to have about another 100 Civil Service people in the shops to be able to better serve the divisions at MSC. The result of this lower than normal ratio has been

that we are unable to match the requirements laid on us by the various divisions through our in-house shops. We generally maintain a six to eight months backlog of work and we have great difficulty in adapting the work request so that it can be performed by an off site contractor.

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We have managed to maintain a highly acceptable level of service through extra effort on our part to find ways and means of accomplishing the tasks at hand. Major credit is due the experience that exists in this division. An endeavor is made to do each job in the shortest and most expedient manner. Without knowhow, we would have drowned long ago. And of course, wherever possible, we use service contracts which has eased the burden of work somewhat.

During the period when Space Task Group was still shaping its organization at Langley Field, a decision was made to relocate at a permanent site in Houston Texas. In the fall of 1961, I was a part of the advance party, which included Norm Smith, Bill Parker and a few other MSC employees. We visited the Houston area as a group to seek suitable quarters for temporary quarters. We arrived about two weeks after Hurrican^{e}/Carla had hit the area and it was kind of scarry. We drove about looking over the property around Clear Lake and with damage everywhere we gained a firm impression that the area was quite subject to hurricane attack. Our wives might not be too happy to move into an area where there is the obvious possibility of extensive hurricane damage. After we drove about and examined the area from the ground level, it occurred to Norm Smith and me that we should rent a light plane, scout the area from the air, and have some fun at the same time. We rented a light plane at La Porte and I took along my

Argus camera. Norm was an accomplished pilot and we flew about the Clear Lake area for about an hour. I took color photos with my Argus and then I swapped around with Norm. He let me pilot for awhile and he took pictures. Our purpose originally was to take home some information for our own wives and families, but we also showed our photography to fellow employees at the Space Task Group and so much interest was generated that we were asked and agreed to conduct briefings on the area for our people. The way we worked it, Norm would narrate and show the slides to one group and I would take the next group. As a result we were able to provide a little advance indication of what the Clear Lake area really looked like.

The Houston area impressed us with its hussle and bussle and its apparent rapid growth and development. The Virginia environment that we were leaving was notably different. Houston, being a large city, also exposed us to much of the environment one sees in a larger urban area.

In our early trips to Houston, as I say, we came with the idea of selecting temporary facilities. It was my responsibility to locate shop oriented space. MSC had decided to locate its offices in the vicinity of Gulfgate, as it seemed to be fairly near the Clear Lake site and offer a fair assortment of rental buildings. The only guideline we had to observe was to find suitable space within a two or three mile periphery of ~~the~~ Gulfgate. Working with Marty Byrnes who was my chief at that time, I rented a car and drove up and down in the vicinity of the Gulf Freeway. We looked at hangar space at the Houston International Airport, then while driving along the Gulf Freeway, noticed several

plants vacant anf for rent. It turned out that the Canada Dry bottling plant on the Gulf Freeway which was vacant was available, the rent was reasonable and it looked quite appropriate for a place to establish a nominal shop. Actually, the first building that we obtained was the Rich Building on Telephone Road. The Rich Building was obtained to provide space for some of them, Dr. Faget's personnel as well as our own. We shipped selected pieces of equipment to Houston from Virginia and acquired other equipment in Houston. We set up our original shop in the Rich Building. Shortly after we had gotten this nominal sized shop into being, I would say maybe about six months, we were able to get the Canada Dry building. After we rented the Canada Dry building I started a planned transfer of Tech Services Division personnel to Houston, a few at a time. It's worth mentioning here that we had to sustain operations at Langley Field, at the same time that we were implementing operations in Houston. What we did was move a few people at a time and some of the quipment and as we built up one of the operations in Houston, we would close down the counterpart operation in Virginia. This went very smoothly and by the spring of 1962 we were in business in Houston completely, but as yet on a very small scale. We transferred approximately 60 Technical Services people to Houston and since that time that number has increased to approximately 220 people.

There were probably no more than five or six people in the Technical Services Division who declined to move to Houston. These included my secretary who was engaged to be married and her fiance was

employed locally. She actually came to Houston for a period of time to help us get over the transitional hump but she did return to Virginia. One or two men who had worked at Langley Field felt that they would prefer to stay in the immediate environment, and we had some people transfer to Houston with us, who after about a year or so transferred back for personal reasons. Most of our employees were well impressed with the Houston area and the only thing that bothered them was the humidity. They certainly liked the type of housing available, the prices were low, and generally speaking, Houston seemed to offer a lot to the average person not only in the way of housing but in terms of lower food and clothing costs as well.

We got established in the Canada Dry Building during the winter and spring and when summer came, we found we had problems. It was really hot. I recall one day when the temperature went to 105° inside the shop building. It was not airconditioned at this time and we hadn't had the opportunity yet to correct this deficiency. However, our employees were dedicated and through these hot days they continued to work under the most adverse conditions. Before the summer was over, we succeeded in getting large portable airconditioning units installed at the rear of the building and in effect air conditioning the entire building.

The type of work we were doing when we first moved into Canada Dry was light sheet metal work, some small precision machine work, and model mockup construction. Our coming to Houston coincided with the early planning on the design of the Lunar Module and I recall that during this period we got a request to build a fullscale mockup of one of the early Grumman-proposed configurations for the LM so that

our Houston-MSC staff could examine it in detail. We were asked to construct this model on a very rapid basis. There was a planned review meeting in Houston with the Grumman personnel and it was deemed necessary to have a mockup here in Houston that we could use during this configuration review. The Technical Services model shop personnel pitched in and constructed a fullscale model using limited drawings and photographs of the proposed model in a matter of six days. They worked around the clock and they had fine cooperation from all the other elements of MSC. This cooperation was necessary to accomplish this task. This job was typical of the way we operated in those days. We would (and we still do) jump in and produce an article that has immediate need and is of interest to the research and development activities of the Center.

We operated our division office in the Canada Dry building for a period of a year or two until it became apparent that we should establish our base of operations at Ellington Air Force Base. The Field Test Branch was located at Ellington. It consisted of a group of crafts type personnel assisting MSC engineers in conducting capsule parachute drop test, flotation tests, and a variety of fullscale field test operations. This type of work which has been common to all spacecraft programs required that the staging area is near an airport where you can work out of a hangar. The space capsule has to have weight and c.g. and balance run on it, it has to be configured for tests, then it's loaded aboard a C119 cargo plane, and air-dropped. On an air drop, parachutes are deployed, data on water and land impact rates are compiled, and etc., and then the spacecraft is returned to the hangar

area where it is refurbished, the parachutes repacked, the spacecraft reconfigured, the center of gravity recomputed, and another test is recycled. This sort of operation had been going on while we were still in Virginia so when we came to Houston, we set up our staging area at the Ellington AFB in Hangar 135. We located our field test branch in this facility along with some mobile equipment, some specialized machine tools, work benches, and the associated electronic, pyrotechnic, and welding equipment that an aircraft mechanic would utilize in assembling and disassembling spacecraft. After the Clear Lake site was nearing completion of the construction phase, I moved my division office from the Canada Dry Building to the mezzanine at Hangar 135 in order to be a little closer to the site and also to effect an improved working operation within the division.

I mentioned earlier that we laid out a plan for a suitable group of technical services buildings and carried this plan to Greenbelt, where it was implemented. It was a fairly simple matter therefore to work with Jim Bayne, of the Facilities Division, and suggest a complex of buildings at the Clear Lake site that would be suitable for a technical services operation. Initially we asked for three buildings, a major machine shop, a fabrication, welding, and sheet metal shop, and a wood and plastics model shop. In conjunction with these three major areas we did suggest that we have a common high bay assembly area where any of the shops could do work on fullscale spacecraft. This concept was similar to the original one I laid out for Greenbelt. The size was

scaled to a facility that would properly support approximately 300 employees and would contain one-of-a kind machine tools suitable to provide quick response service to the R&D elements associated with the Manned Spacecraft Center. As it turned out, the original proposal to Congress for the Manned Spacecraft Center facilities was cut back somewhat and one of our buildings was dropped out of the approved program. So we reconfigured our facility with two wings, one for the machine shop and the other to co-house the sheet metal welding department and the model and plastics shop with the high bay section between them. This facility, Bldg 10, was completed in 1963, I believe, and provided an excellent base for our operation. Building 10 has two mezzanines, one of which was set up for the electronic branch and the other to accommodate our fabric and parachute facility. We operated out of this facility along with Bldg 8. Bldg 8 was an office building immediately in front of Bldg 10 on the mall and there our division personnel, our branch heads, and our planning and scheduling office were housed. We have since moved out of the Bldg 8 and occupied a third building which was earlier knocked out of the facilities master plan. We had submitted our need for an additional building to a succeeding Congress and had received approval. This building 9, was acquired in 1966. Upon the acquisition of Bldg 9 we pursued our original plan of utilization of the space. We moved the model and plastics shop out of 10 into 9 and are currently reconfiguring the west wing of Bldg 10 to accommodate the sheet metal and welding branch as originally conceived. In reflecting on acquisition of facilities, I would say that our master plan was reasonably sound. It has been adhered to

in two instances both at Goddard and here and it's essentially the plan that I felt was needed to perform our function when I first joined Dr. Gilruth in Langley Field, Virginia. Although I spoke of three buildings, actually Bldg 10 encompasses two original buildings that are attached to each other by means of a high bay area in the center. With Bldg 9, we have a complex that is probably one of the best in any of the NASA Centers for providing technical services support activity. The only improvement I could think of would be to have Bldg 9, which is across the street from 10, contiguous to the high bay--in other words, a three-sided, three-winged complex which would provide inter-support activities without going outdoors. As it is now we do have to leave one building and cross the street and enter another and there are times when the weather might be a factor in moving a space-craft. I think it's worth mentioning also that this complex of combined buildings carries out a philosophy that I picked up while working at Langley Field. That is, Civil Service can be utilized more beneficially. Having our various specialized crafts co-located makes it possible for people to work simultaneously on jobs whenever this is of advantage. Our sheet metal and machine shop people and possibly a model shop representative all working together on a mockup or space-craft in the high bay. This leads to more efficient use of the space and certainly saves time in trans-shipping from one department to another.

Another element of Tech Services Division, the Film Test Branch, from the beginning has been an active support organization. It assists R&D personnel in the Structures and Mechanics Division, the Vibration

and Acoustics, in the Thermochemical Test area, etc., in those tasks that have to do with field operations and where there is a requirement for craft assistance and specialized knowhow in cranes, rigging, pyrotechnics, spacecraft assembly-disassembly services, etc. Typical of this sort of service is the work that we have done at the White Sands Missile Range. We have repeatedly sent personnel like Roger Messier and Gene Waldren up to White Sands to assist the launch crew in the Little Joe shots. Gene Waldren and Roger both have quite a bit experience with pyrotechnic sequential devices and are familiar with technology requirements and safety considerations.

In addition to the work at White Sands, another section of the Field Test Branch, Parachute Support Section, has made repeated trips to the El Centro, China Lake, and elsewhere. These areas were originally used for Mercury, then Gemini, and finally Apollo landing systems tests. These tests were conducted to verify the suitability of parachute systems to safely land the spacecraft. We have personnel at the present at El Centro monitoring and surveilling the prime Apollo spacecraft contractor in parachute development and testing.

We have sent our personnel to the Downey Plant of North American, to Rocketdyne, Bell Aerospace in Buffalo, and other manufacturing plants whenever it appears that the Project Office needs surveillance on a manufacturing item because of a possible fault in the manufacturing process. We have been very successful in pinpointing some of the explicit manufacturing problems and in recommending corrective actions. Our most recent action of this kind was through membership on a source

board to select an alternate ascent engine ejector manufacturer. After the award to Rocketdyne, tech services personnel continued to participate in field visits to see that the manufacturing plan of this alternate injector would indeed progress rapidly to a successful conclusion. Meantime, our personnel made periodic visits to the Bell Aerospace Plant to assist that company in improving their manufacturing process on the injector that they are manufacturing.

At the Clear Lake site, I think an example of what we do with the shops personnel is evident in a review of participation in work done on the large space chamber, the SELS. We encountered a major problem with Chamber A during the initial construction phase. It turned out that during the shakedown pressurization test, the 40-foot door area was underdesigned structurally and as a result, it deformed and leaked during the original pumpdown. The Structures and Mechanics Division under Mr. Kotanchik launched an immediate investigation and re-evaluation of the structural effort. They in turn determined they wanted precision machine scale models constructed of the space chamber that could be equipped with strain gages which would become laboratory prototypes and would gather data on alternate structural configurations that might account for underdesign or for the deflection around the door. Based on this input from Structures and Mechanics, the Tech Services Division made a fullscale drawing of the space chamber and constructed a scale model about three feet in diameter and five feet tall.

Bill Lee in our machine shop, used some of his most skillful machinists to build a very precise model of the chamber and tooled it

from a circular billet of 2" thick boilerplate steel. This job was machined on a boring mill over in Bldg 10. Then it was transferred to a milling machine and all the structural webs that were represented on the fullscale model were duplicated by milling away material from this 2" billet to the point where the skin of the space chamber was 1/100,000ths of an inch thick and all the remainder of the 2" thick material was represented in integral structural beams, external beams and girders, etc. You can imagine the care and precision that were required in the carving, so to speak, of the integral model from one chunk of material, so that a very thin-skined base cylinder with integral webs on the outside (representing the girders and beams) resulted. This model was built in the shops on a three shift basis using the Civil Service craftsmen and then it was transferred to the Structures and Mechanics Division where strain gages were applied to the various beams and skin surfaces, and the entire model was then vacuum loaded and deformations were measured precisely. Out of this series of measurements the design analysts were able to come up with corrective measures. Resulting from their analysis a second model of a similar type was made. This time the model had reinforcements around the door and those proposed stiffening agents that would in effect make the fullscale chamber vacuum worthy. We built the second model along similar lines in record time and got it out and it too was strain gaged and tested. As a result, the precise recommendations built into this scale model were then given to the prime contractor for his change order data to rebuilt the space chamber and bring it up

to performance level necessary for manned testing. This project was completely successful and the space chamber passed its vacuum test with flying colors based solely on the results of the scale model work and the accompanying analysis.

Another type of support activity coming out of the shops area in regard to the SESL was the design of the liquid nitrogen joint that fitted into the rotating turntable in the base of Chamber A. Upon installation it proved to be ineffective. A considerable amount of effort was put in corrective measures, changing seal configurations, etc. Finally the Center management decided to go to an alternate design on an in-house basis. As a result of this decision the Engineering Division provided an entirely different joint design that consisted of a group of articulated pipes interconnected with rotating seals that would permit the liquid nitrogen to be transferred from the source into the chamber proper during a rotation of the floor plate. On the LN_2 joint project we utilized machine shop personnel and our heavy machinery to manufacture the alternate design. We put it together in the high bay area of the shop and ran performance tests, and certified its suitability using shop personnel and Engineering Division personnel. Subsequent to the proof test at the shop, the seal assembly was put into the chamber using some of the support service contractor effort from Brown & Root/Northrop. The unit to this day is operating quite satisfactorily. This type of effort continues whenever a problem develops in one of the laboratories with a major piece of equipment.

The first step is to get an analysis and determination from the Engineering Division, after which Engineering generally comes up with a recommendation for modification or redesign, which in turn calls for fabrication and installation. At this point the Tech Services Division provides their input into fabrication, and suggests means of accomplishing the corrective measures that will simplify the job and get it installed in the shortest possible time.

On occasion our Electronic Branch put in a good deal of cabling and installation work plus the device called RIMS (radiation intensity measuring system). NASA designed a radiation measuring device for use in both Chamber A and B. (It was built in-house by Tech Services Division and has had a large number of its electronic components built by our Electronic Branch under Mr. Prine's direction). The model shop activity in Bldg 10 under the direction of Charlie Tucker, Charles Nagle, and Fred Chalfont, tends to support the simulation activities. We have a fair number of fullscale capsules, mockups, etc., scattered about the Center and many of these originated in the model shop area. Once they are transferred to the user, there is a requirement for continuous updating, and we use our model shop personnel for this. We have made models for the Flight Crew Support Division, for IESD, and Flight Operations Directorate.

Our concept of the function of the Tech Service Division Civil Service staff has undergone a gradual changeover the last few years based on several factors--staffing limitations, and the necessity to concentrate on mission oriented services more than perhaps plant oriented services. For example, when we originally organized the Division,

the Maintenance Branch was to be staffed with Civil Service personnel. We assumed that we might use the staff to do maintenance similar to that done by the staff in the shops area. The moment it became apparent that there would be staffing limitations, I began to seek service contract support for the maintenance activity at the Center. This had a secondary effect of affecting some of the wage board classifications of the employees. Originally we had ~~an~~ electricians, refrigeration mechanics, cryogenic technicians, etc., under the wage board series. As these men became contract monitors rather than working blue collar workers we recognized the necessity of converting them to class act and changing their grade structure. As a result, there has been a gradual transition of wage board personnel over to the GS 300 series. This is particularly dominant in those areas where contract monitorship rather than direct productivity by our own personnel is significant. Wherever we supplemented our electronic Civil Service staff with an onsite electronic repair and fabrication contract service, we have had to delegate some of our personnel to the contract monitorship role. At the same time, it freed the remainder of our electronic staff to pursue more sophisticated work than is classically done by electronic technicians or engineering technicians rather than the conventional wage board and electronic worker. I think we can say we have benefited to a degree in that we have found a way to transfer our excess workload to the contractors, and concentrate our limited Civil Service staff on the more critical areas that are more

closely program oriented.

In reassessment our staffing requirements made by Personnel Division, it was determined that our electronic branch should be totally classified GS, where formerly they were wage board. Similar audits have been made in other departments in the Field Test Branch, for example. We are gradually converting the pyrotechnic workers from wage board to GS and are similarly converting the parachute specialists and the installation machinists. The work they do is totally mission oriented, experimental in nature, and tends to support the engineering technician type job description as opposed to the more conventional wage board worker.

Since we had limited capability in electronics in the various divisions about the Center, and other divisions had some limited electronic capability directed to their specific interests, it soon became apparent to us that we needed to buy a larger electronic fabrication and repair service than we had onboard. This contract supports our Electronic Branch and it presently has approximately 50 personnel providing fabrication and repair services. Our Field Test Branch consisted of about five people and at times we needed as many as 30 to 40 personnel to accomplish this type of work at the Center. For example, stacking a spacecraft in the Vibration Acoustics Facility on an urgent basis requires a considerable staff of blue collar rigging support personnel on a two or three-shift basis in addition to our Civil Service personnel who provide model shop, machine shop, and metal working services. We placed the responsibility for the rigging service under our section chief, Mr. Lyman Lee and he has done an admirable job in carrying out this function despite its growth by leaps and bounds as

the Center's test facilities have become active. It's not uncommon today to have 12 or more calls per day to bring in a crew and erect, tear down or move a spacecraft or a large piece of test gear in connection with one of the Center's mission oriented programs.

Since it was evident that the shops organization were to be limited in size, it was also apparent that we should introduce a means to get additional services of the shop type in the Houston area. This affected our internal organization in that each time we increased our purchases of shop services, we loaded our planning and scheduling office more heavily. It became necessary to transfer shop personnel into the planning and scheduling element of Technical Services Division in order to have a balance of people to perform this larger function. In our eight years of experience at the Center, we have learned that skilled craft personnel are quite knowledgeable about materials, processes and methods in manufacturing and therefore they make excellent planning and scheduling personnel. Mr. Frank Parmenter who handles this particular area, is an ex-apprentice graduate from the Langley school as is also Howard Allison, the supervisor of our planning and scheduling office. As a result of his determination, we have numerous employees in planning and scheduling who originated in either the machine shop, the sheet metal, the electronics or the model shop areas, and as such they compose a very well rounded planning group and provide a great deal of assistance to the various NASA-MSC Divisions who are planning to have work done but aren't entirely sure of the best methods to pursue. For example, a person will come in and discuss with us the relative complexity of building a mockup

of sheet metal or plywood covered with perhaps fiberglass sheeting. These decisions are made on a daily basis and are one of the services that we render to the Center. We have not attempted to establish an on-site supplemental machine shop service, sheet metal, or model type work, and the reasons are two-fold. First, these services are the type that with proper planning and scheduling can be jobbed out in the Houston area. The second problem that has kept us from bringing support service onto the site for these functions is the national shortage of skillful people generally in the machine crafts. There is also difficulty in using the same equipment for both Civil Service and contractor operations. To be more specific, we feel we should retain the Civil Service staff and their equipment on an accessible basis so that we can have and give the quick response service that we now do. If there is a serious immediate need for a component to be built or modified and if we were to staff this same area heavily with contractor support we would reduce our flexibility in effect by loading machines with work that might interfere with our responsiveness. In summary then, the division has drifted to a pattern of using its nominal Civil Service staff for the most selective effort on the most sophisticated and difficult projects that are needed to support the mainstream effort, and we are supplementing this limited capability by using job shops off site or using in some cases on-site resident contractors where we have the space and equipment and the presence of the contractor does not provide interference with our Civil Service activity.

I feel like the typical MSC employee of the Technical Services

Division has become reasonably involved in community, church, and school activities. The Junior Achievement Organization in Houston was interested in establishing an outpost at the Clear Creek School to handle all the new students that were coming into this area and get them interested in this program. This is a national program sponsored by the business organizations in various cities to attempt to teach high school seniors the principles of the free enterprise system. So a survey was made of the aerospace companies in the area and NASA itself was approached to support the program. David McGraw, Ed Campagna, and I volunteered to work on this program in the name of NASA for a year and sponsor one of the junior achievement teams. Our sponsorship then consisted of going on a regular basis one night a week to Clear Creek High and assisting a group of about 20 high school seniors in gaining an understanding of such subjects as how typical companies are organized, the profit motive, how records and books are kept, and how a company choses a product. The practical aspect of the training comes when they select some item that is not too difficult to manufacture that has sales appeal, that they can hopefully make a small profit on, and as a result learn all the elements of business. One junior achievement effort features the production and sale of a desk pen set--a model of an astronaut was mounted with a fountain pen on a walnut base. The product sold for about $3.00 and received quite a bit of interest, and made a little money for the group.

Several of my employees are active churchmen, have participated in building programs, and also there is much active participation in PTA, Boy Scouts, and things of this kind. I became treasurer of the Troop 895 in Seabrook and my fellow committeemen seemed to be all NASA personnel. I sometimes wondered who ran the civic activities before we got here. In Timber Cover, we have a volunteer Police Department, Fire Department, and maintenance committee. I think we have launched ourselves into community affairs and are doing more than our share.

Langley Field, Virginia was the original NACA Center. In 1940 an apprentice program was begun to draw in from all over the country young men who were interested in the aviation field as a hobby. It was felt that some probably would be interested in pursuing an active career in aeronautical research. So with this existing background at Langley Field and since the Space Task Group and the Manned Spacecraft Center management staff came largely from this environment, it was not surprising that we recognized the need for an apprentice training program at the Manned Spacecraft Center when it moved to the Clear Lake site. We had a staff of wage board personnel that we brought in, and we had a similar environment in which to plan for the future--in other words a permanent set of shop facilities and an R&D environment that dictated the need for highly sophisticated specialized personnel. In 1963, Mr. Purser called an organizational meeting. Joe Piland, Aleck Bond, Ed Samfield, Sig Sjoiberg, Chris Critzos, and I formed a committee that later became the Apprentice Technical Institute Advisory Board. We set up a plan to advertise for apprentice nominees in the machine shop, electronic, model and plastics areas and in sheet

metal and welding. Initially we felt a class of about 10 personnel would be sufficient to start with. We decided to use the educational facilities of the University of Houston and San Jacinto College for related academic studies. We enrolled apprentices in the fall of 1964 and began our apprentice program. We engaged Mr. Robert Sinter in the personnel division to act as the apprentice administrator. We've had a very successful program to date. We are now in our fourth year and will graduate our first class next spring. We are up to 35 personnel in the apprentice program at this time and have approximately 1/5 of the shop craft group represented in the apprentice program. In other words, about one of every five personnel at the machine tools in the shops at this time is an apprentice. Apprentices are given on the job training by our supervisors and selected skilled personnel. They attend school approximately nine hours a week at the University where they take college credit courses. At the end of four years, they will have the equivalent of two years of college education plus four years of intensive training at the equipment within the shops. We look forward to this program as a means of sustaining our skill levels here at MSC and are confident that we will reap a real benefit from this program. Across the nation there is a lack of interest in skilled craft work and therefore when you go out and announce for apprentice applicants, you get people who seem to have no other interests or feel they can't make it in some other field. There is this tendency to get personnel of limited qualifications. As a result, we have stringent examinations and we have selected only 20 from as many as 500 applicants in order to get the quality person that we need for this program. As

long as we reach out for enough, we are able to find suitable personnel for this program, but generally speaking, there aren't enough young people interested in apprentice training here or anywhere across the nation.

We have lost one or two apprentices in the first three years. Some have transferred with their families to other areas of the United States, and we have had one or two who have dropped from the program because they were failing in their academic studies. However, most of the people are progressing very well and we anticipate their further advancement in the Manned Spacecraft Center either by transfer to divisions like Engineering where they might pursue an engineering design future or move up in management within Tech Services Division, as openings develop. It's also anticipated that some of the apprentices who complete their training will choose to complete another two years of college and move into engineering jobs throughout the Center.