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ORAL HISTORY INTERVIEW

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Oral history interview with Robert R. Gilruth
[full name of interviewee]

about STG and early years of MSC
[main focus of interview]

Title: 1962 - Director, MSC
[interviewee's current and/or former title and affiliation]

1968 - "

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 17; # tapes 1]

Master 1

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

Topics - Evolution of MSC: Manned Satellite Division (Goddard),
Project Mercury; Ham (chimp) flew early 1961; Shepard
5-5-61; MSC resulted from Pres + Congress decision
to land man on moon; opinions about Selection
of Houston; getting organized w/ 3 project offices
(Mercury, Gemini, Apollo); Key Office Leadership Changes;
Apollo fire; problems; move to Clear Lake Site
March 1964; development of Space Science program;
AF-NASA relations/competition; Kennedy
administration select committee on space prog;
skepticism of scientific/medical community;
original seven astronauts; policies re astronauts
"rules of department"; Space Task Group beginnings;
relations w/ MSFC; Drainerd Holmes at HQ
(Manned Space Flight); MSC facilities; White Sands;
Assigning working w/ MSFC; support Contractor system
elements to

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References Documents

Statement 21: robert ss gilruth

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04-17-69 JSC 00                             1 INS GILRUTH                079-2
Oral history interview with Robert R. Gilruth about Space Task Group
(STG) and early years of Manned Spacecraft Center (MSC). Former MSC
Director. Interview conducted by Robert B. Merrifield, Staff Historian.
Tape and edited typescript. CONTENTS: Topics - evolution of MSC:
Manned Satellite Division, Goddard Space Flight Center; Project Mercury;
1961 flights of Ham (chimp) and Shepard; MSC resulted from President and
Congress decision to land man on moon; opinions about selection of
Houston site; getting organized with three project offices (Mercury,
Gemini, Apollo); early key office leadership changes; changes after
Apollo fire; problems in early days; March 1964 move to Clear Lake site;
development of space science program; Air Force-NASA relations and
competition; Kennedy Administration Select Committee on space program;
skepticism of scientific / medical community; original seven astronauts;
policies for astronauts; "rules of deportment"; Space Task Group
beginnings; relations with MSFC; Holmes at NASA headquarters in Office of
===== Last reference =====
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Gilmuth - do you
recall who, MSC
or Hqs made the
site selection of
White Sands.

Was there any
consideration of ^{major} MSC
responsible for the new
testing site
as Direct, where did you
- Focus attention on
what areas - i.e. program

- rational behind buying
program office small

- How would you describe your role
as Center Director, as a Project
Officer & Director?

- When you realized you were to
become an independent Center,
what ~~was~~ ~~objectives~~ capabilities did
you want the Center to have?

Lecture

§ 3/4 10 - subsystem management

- ✓ - fundamental theme - Engineering a technology oriented group (p. 11) → purpose & organization
- ✓ - + resolve problem of overspecialization
- ✓ - Utilize the tension in the system.

Gilmer

Q¹ - Is it practical to have project offices as large dedicated shops

Q² - Is it useful to build an organizational layer between one alternate for a Director of Projects → why is this not chosen

Q³ - Will SSC change?

Questions for Dr. Silworth

- The STG first organized into three divisions
Flight Systems under Foget
Operations under Motheurs
Engineering & Contract Administration
under Zimmerman

Do you recall why you organized in this fashion

- When you realized the STG was to become an independent Center, what capabilities did you want the Center to have.

- Do you recall who, MSC or Hqs made the site selection of WSTF.

- WAS THERE ANY CONSIDERATION MAKING MSC RESPONSIBLE FOR WSTF

- As Center Director where did you tend to focus most of your attention.

- THE PROGRAM/PROJECT OFFICES HAVE TENDED TO HAVE A RELATIVELY SMALL NUMBER OF PERSONNEL. - WAS THERE A BASIC REASON FOR THIS

- Floyd Thompson & LSC filled in where we didn't have admin. capabilities

Floyd Th. realized the STG was the future of NASA. He knew that if we didn't move into space - then

made me Assistant Director of Goddard, which I didn't like.

Didn't make sense to have a project of that nature reporting to the Asst. Dir. It became obvious this was not the right thing to do.

This was all forgotten after Shepard's flight.

~~all~~ all started w/ Mercury when Floyd Thompson did all he could to help us get started

→ That lots of problems in getting

→ finish Mercury

→ start Apollo

→ have to go from no experience in space to weeks in space

→ Had to implement Gemini in time to support

→ Had to recruit

→ Had to design & build Center

→ Had to think about organization

- expand astronaut

- 57 temporary building

- lot major contracts

- how do you put it together to manage it.

lucky to have Wes Elms - knowledge,

- Building Center, contract work, limit ways to ~~do~~ money

= technical organization - Jim Elms did this for us.

Elms almost a genius at organizations, stayed only about
a year - but after that time

~~I was expected to see Elms in~~

- Elms was able to convince Webb that we were ~~all~~
properly organized.

→ was able to hang together during the fire - hang

→ Project office size was never an issue - we
had so many projects that large project offices
were not practicable.

→ As knew that top mgt. wanted that way.

→ I had to pay attention to what was going on in
all areas -

Max - for technical aspect

Peg -

Jim - for resources —

→ White Sands was my decision
- was an easy decision, cheaper

→ We never wanted to do it that way
- MSFC had a big job w/ Saturn
- we wanted direct control of our system
- another ~~an~~ interface
- we had only a simple interface

- even w/ that interface we had problems
- not able to keep it - LEM engines! SM engine
worked.

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INTERVIEW WITH ROBERT R. GILRUTH
April 17, 1969

MSC started with the old STG. It was created when ^{Dr. T. Keith Glennan} Glennan instructed me to get on with the project to put man in space. At that time it was a one project organization, but it had all the elements we have at MSC today, with a few exceptions. It included the hardware development team which is responsible for conceiving the plan, writing the specifications for it, and conducting the exercise with industry to get bids and select contractors. We had the operations team which set up the method of operation and implemented it. We had the crew systems element responsible for selecting and training astronauts. Of course all this was on a much smaller scale. The original astronaut corps consisted of only seven men. We also had to conceive the techniques for selecting astronauts and training them. Now we have quite a backlog of experience. But the tasks are by and large the same.

During the early days we were kicked around from one place to another. At one time, we were an element of the Goddard Space Center called the Manned Satellite Division. I served as director of Project Mercury and as head of the Manned Satellite Division of Goddard. You can guess which title I liked better. About Christmas 1960 Dr. Glennan, at the advice of Dr. Seamans, decided we were reporting too low down in the organization and made us an independent group reporting directly to Washington. We were then about ready to make our first manned flights. We flew the chimpanzee, Ham, early in 1961 and Commander Shephard May 5, 1961.

We then had no ongoing program. Mercury was a deadend program and it would be expected that the whole STG would phase out after the specification

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mission was done. None of us ~~really~~ thought this would really happen though. In May, the President and the Congress decided on instituting the Apollo Program, so we went from having no program in the future to the tremendous challenge of landing a man on the moon--and in a very short period of time. That decision really led to the creation of the Manned Spacecraft Center. With the advent of the total Apollo plan, it was obvious to everyone that a much larger and stronger group would be required to manage the spacecraft and crew end of the business. Mr. Webb came as Administrator about February 1961, and created a site selection team to canvass various spots around the country for a suitable location. This team together with Mr. Webb and others selected Houston as the site for the Manned Spacecraft Center. Although there may have been considerable political influence in this selection, it was a good choice of location. We needed a place close to the sea for our recovery development tests and recovery readiness tests (the Gulf of Mexico has served as a basic proving grounds for our spacecraft); we needed to be near a large government air field, and we have Ellington; we wanted to be near universities so our people could continue their training (and there are good universities in this area); we wanted to be centrally located on air traffic routes because our contractors are generally on the West Coast and the Cape is on the East Coast. We needed to be in a place where people would like to live. A large metropolitan center offers many cultural and shopping advantages. These factors are all present in this area, so I have been very pleased with the selection that was made. However, I will be the first to confess that I was not enamored with the selection when it was first announced, or when I first looked it over.

Our organization went from a single project organization for Mercury

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to a multiple project organization when Apollo was brought into the picture. Almost concurrently a Gemini Program was instituted to help fill the gap between Mercury and Apollo, although it was not announced formally until December 1961. Thus we went from a single program center to a three program center. However in the two new programs we had more limited responsibility than we had had in Mercury. We organized in the usual straightforward fashion. We simply instituted project offices and we tried to keep the project offices reasonably small, and drawing needed institutional support from other elements of the Center such as in the crew area, flight operations, basic engineering and science. In our early days there was perhaps the usual amount of difficulty in getting the project offices to learn how to work with engineering support people and the other support groups. It's characteristic that project offices always want to have all of their resources in their office including administrative and technical support. We went through this phase in their development.

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In regard to the many changes of leadership in the key offices, I think this was to be expected in such a dynamic activity as we had in Apollo. Charlie Frick was our initial project manager. He did a good job in getting the program started in a hurry. He had a lot of problems because we were operating out of rented buildings, and were doing a lot of things for the first time. Also N-R was not the easiest contractor to manage, because they had to create a whole division to do the Apollo job. Piland took over after Frick left and held the fort until we got Joe Shea. Joe stayed with us for quite a while and carried the project to a late state of development. At this point we were interrupted by the tragedy of the Apollo fire and from then on we had to put all our energies and our best efforts into getting out

of that difficulty. I think this accounts for the turnover in the project office.

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In the early days at Houston we had many problems. We were attempting to organize an Apollo Program Office under Frick and Jim Chamberlin was managing the Gemini Program out of the VA Building in downtown Houston. We couldn't get his group close by our headquarters at the Farnsworth-Chambers Building. We were really doing a juggling act at that time. Putting John Glenn in orbit ~~coming~~ was number one priority. Yet we realized that the timescale on Gemini was extremely short, and had to get it rolling fast. Apollo was a very demanding third program, and at the same time we were trying to organize groups and design a new Center out here at Clear Lake not to mention the hiring we were doing at that time. I remember one day Mr. McDonnell, head of McDonnell Aircraft Corporation, now McDonnell-Douglas, visited me. I showed him what we were doing, and he said "Bob, I don't want to be discouraging, but I don't see how you can possibly get done all the things you have to do." But somehow or other we did them. ~~and~~
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I think we are all proud of the Center that was created and the record *we have made on* Gemini and Mercury and thus far in Apollo. We had a lot of good people who were hard working and perservering and weren't easily discouraged.

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The move out ^t to the Clear Lake Site was accomplished in March 1964, and it was a great revelation to many of the folks at the Center. For the first time they could see all the people who were working with them. Up until that time most of them had never seen the whole Center together in one place. In the following summer we brought the Mission Control Center into operation and it controlled its first mission with Gemini 4. From that time on we had basically all the elements that were required for conduct of our

programs with the exception of space science. We had long recognized the importance of having a strong science input into manned space flights and through the efforts of George Low and others we brought Dr. Hess to MSC. He has been busy for the last year or so in attracting leaders from the scientific community, such as Dr. Bell and others, into coming to work with us.

The Lunar Receiving Lab is a part of the science effort although it is also a integral part of the initial operations of Apollo. All of these things have greatly complicated a fairly simple type of organization and the mission we had with Mercury.

Why were the computers used in the Mercury program located at GSFC rather than at the Cape? Dr. Silverstein wanted it that way. I was in favor of locating them at the Cape, because I was afraid we might have some transmission line failures and I thought it would be more reliable at the Cape, but I have to admit it worked very well the way he wanted it done.

54 We sent Scott Simpkinson and Merritt Preston, who were both members of the STG, to Cape Canaveral. They were to be given a part of the old Vanguard Building, which was Hangar S, in which to assemble the Big Joe capsule. It turned out that the advance work by Mel Goff, NASA's representative at the Cape, wasn't very good, and we were literally given what amounted to a janitor's closet in one corner of the floor and were expected to do this complex spacecraft work in it. It took some negotiations to improve this situation. I remember how shocked and disgusted Scott Simpkinson was at the time. But this is a part of growing and within two years we had that whole hangar and had built a building along side it to house

the engineering offices. Things really moved very fast. It just seems they moved slowly when we were trying to get a job done in a hurry.

64 There was a meeting at Wallops Island called by Abe Silverstein in late 1960. I remember it had to do with Gemini and there was also a great deal of discussion about Apollo. I remember George Low, Walt Williams, Chamberlin, and myself, and no doubt many others such as Max Faget were present. We discussed alternative missions in earth orbit, rendezvous, and circumlunar flights. We even discussed lunar landing although at this time I don't think we knew we were going to be involved in a lunar landing mission so soon.

17-1 To what extent did the AF-NASA contention over space roles and functions hamper MSC in its attempt to acquire qualified personnel? I would say very little. We've always enjoyed very good relations with the AF, and we had a lot of help from the AF initially. Dr. Stan White came from the AF and worked with us from the early days of Mercury through our move to Houston. I think he did an outstanding job of handling our medical equipment problems, etc. We've had many other AF assignees and at the present time, we have maybe 150 or so young AF officers who are mostly located in Dr. Kraft's Flight Control area. We have a large number of AF astronauts and there are also skilled AF people in Guidance and Navigation and other technical areas in the Center. Initially, before the formation of NASA, there was quite a bit of competition between the civilian NACA and the AF as to who would get the manned space program, but once it was decided, we've had nothing but good relations.

45-1 I like to maintain communications with my people through personal discussion and contact. I try to do this, but it's not always possible. In

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the case of Mr. Low, we have a very good system which works to the benefit of both of us. Each day he gives me a set of Apollo notes of key things that happened that day on Apollo. These are well written, short, and are a great help in keeping me abreast of the problems he is running into and how he deals with them. They are a help to him because it gives him an excellent record of what happens each day and helps clarify his management process. I think hideaway conferences are good at times but I think they are used far too much, particularly by my boss. I believe in them when a subject is to be discussed that needs great concentration, but I don't think they should be used to handle routine business. They should be kept to a minimum and be held only when there is a real good reason.

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The Mercury Project was in a difficult situation at the turn of 1960, as the old Eisenhower Administration went out of office and the Kennedy Administration came in. We were approaching our first manned flight and I wasn't going to ask any astronaut to fly on a rocket until someone in a very high place--preferably the President--stood up and said "this is an important mission for you to do young man--important to the country and important to all of us." You will recall at that time there were a number of highly placed scientists who were downgrading the manned space effort and said it was not worth doing, an unnecessary risk of lives, etc. President Kennedy had appointed a select committee before he was elected and he made a number of observations about the space program. We supposedly were over emphasizing the manned aspect of space; we were seeking too much publicity; we were using the Atlas when they felt the Titan rocket was a better bet for launching our man, etc. When the Kennedy team took office and as we approached our first manned flight, I felt that someone should sign off

on it as being an important thing to do. Also the Kennedy Administration didn't know much about Project Mercury. Kennedy appointed a PSAC committee headed by Jerry Weisner. He had also been a member of the so-called select committee Kennedy had before he was elected. They investigated Project Mercury from all aspects--the engineering side, the operational side and also from the medical side. We came through this investigation pretty well, and we thought we had satisfied all their questions until the very last day when a number of the medical people came in with a vote of no confidence. There was a real doubt in the minds of people such as Dr. Livingston and Dr. Hartgering and a consultant by the name of Fishman. These people believed the human heart would stop beating at zero gravity and they wanted us to engage in a great deal more testing of chimpanzees in centrifuges. I remember at one point they were talking about testing so many chimpanzees that I facetiously suggested we should move the program to Africa in order to have an adequate supply. At that point Mr. Webb took a hand and told this group that we were going to fly unless they stopped us and they better have a good reason for stopping us, because whatever it was they said he was going to see that it got on the front page of the paper. It seemed to me they were flying in the face of some very strong evidence, and that there really wasn't a serious problem at zero gravity. We went ahead. As everyone now knows the Shephard flight was a very great success--so successful that it made President Kennedy realize what power space had. I spent a fair amount of time with him during those days and I know how impressed he was at the effect space had in measuring a country's technical and political progress. This I am sure had a lot to do with his decision to go for the lunar mission, which he announced later that same month.

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A group of us, including Wes Hjernevik, Walt Williams, myself and several others came to Houston shortly after the decision was made to locate the Manned Spacecraft Center here. Hurricane Carla had just hit the area the previous week. It was a very hot, September day. We had still not flown our man in orbit, we all had been working hard and were tired. Before we came to the Clear Lake area a suggestion had been made by Dr. Dryden that we might be able to locate our STG personnel in the old West Mansion garage. Now the old garage in the West Mansion wasn't big enough to put a home workshop in. Obviously he hadn't seen the Old West Mansion garage or he never would have made that suggestion. We were hot, there were insects, and the local region looked like a disaster area--even the foliage had been stripped from the trees, burned off by the salt spray of the hurricane. It was far from being an attractive area. You can imagine we were rather discouraged. EAFB was little better. It was a World War II base composed of wooden barracks only partially occupied and certainly wasn't a shining new place ^aone would want to move to if he was making 1500 mile move. We'd hoped for something better. Even though we were all very discouraged I think we made an important decision that day. We decided we wouldn't try to locate at EAFB, but instead would rent buildings down near the center of Houston where it would be easier to work and where we would have a better chance of attracting the kind of people we wanted to get. That was a very low point in our impressions of Houston. We got an entirely wrong impression of Houston by that trip as we later were to find out.

The original seven astronauts reported to me and I've always had good relations with them. There were some difficulties, of course. When Slayton

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was told he couldn't fly by the doctors because of the anomaly in his heart-beat, that wasn't a problem of line organization; rather it was a real trauma in his life and we did everything we could in our organization to help him. Bill Douglas, the Flight Surgeon assigned to Space Task Group and I both made trips all over the country. I went to see Lovelace to see if there was anything to be done and Douglas went to see Dr. White the famous heart specialist in Boston. On one occasion, Vice-President Johnson invited the seven astronauts and me to his ranch. We spent a day and night talking about problems like whether or not astronauts should be allowed to receive houses as gifts. Mr. Sharp at Sharpstown offered each of the astronauts a house, and some of the astronauts thought they should be allowed to accept them. We had some problems working out rules of deportment that were reasonable. We did this within a minimum amount of time and problems, but they had to be worked out. There were also a few instances where the competitive spirit of the astronauts overcame their sense of propriety and some things were bubbled over into the press such as the feuding that went on between Schirra and Glenn for a time. There is still some of that and there probably always will be. But by and large there was no improper use of acquaintances in high places to get their way.

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Back when we were getting started with the old STG, Floyd Thompson was head of LaRC. He went out of his way to help ^{me} ~~he~~ recruit top guys out of LaRC to work with the STG. With his backing, I signed my own letter of authorization and sent it to him telling him I was authorized to establish a STG to put man in space, and asking him to turn over 34 people to me. I even named the 34. This is evidence of the excellent relations we had with Langley. Dr. Thompson was a very practical man and he realized that the

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future of the agency depended on how well we succeeded in putting man in space in the Mercury Program. He gave us all the help he could. Lewis Research Center also gave us a number of very good people. The situation was a little different there because Abe Silverstein moved from Lewis, where he had been director, to Washington and became our boss, so it made it quite easy to transfer people from Lewis to STG. KSC was not a launch Center at that time. Dr. Debus was the man in charge of launching the rockets at Marshall and we worked more or less independent of KSC, except for KSC's overall surveillance to keep us in line with policies and procedures. We had our own launch directors and our own personnel at the Cape and our relationships with Cape people were quite good. We had a minimum amount of intercourse with Marshall. They did produce the Redstone Rocket for us in connection with the suborbital flights of Mercury. I would say we had more than our share of difficulty in working our arrangements with them. They wanted us to send the capsule down there for complete integration with the booster which we would not agree to. But this was a small part of the program. We flew four Mercury spacecraft on the Redstone. MSFC had no part in the Gemini program. They have a major part in Apollo, but the relationships aren't so much between Centers now as they are between Centers and Headquarters. We now have good relations with MSFC.

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A little over two years has passed since the 204 fire. We had a dangerous situation that had gradually developed so slowly that none of us realized just how much flammable material was getting into the spacecraft--not just that that was standard material, but material brought in for special tests. In the Mercury Program when we decided to use pure oxygen on the pad, the danger was recognized. We felt it was reasonable to use pure

oxygen to avoid the bends and that is why we followed that procedure. However, later on we used the same procedure over and over again and even during simulations. And it was a simulation that was taking place at the time of the 204 fire. We had pure oxygen in at a time when it could be argued we could have simulated it with normal sea level atmosphere in the cabin. I would say the whole thing could have been avoided had we realized how great the risk was, and we would have devised procedures that would have been appropriate, without going to the lengths we did after the fire when we attempted to eliminate all possible flammable material. We now use diluted oxygen on the pad. We now have a very carefully tailored situation that reduces the risk to a minimum. There undoubtedly was somewhere in between that procedure and the one we were using that might have been used had we had a better perspective and more wisdom. I think there are very few accidents that one can't look back on and see how the risk might have been minimized. It's difficult to pinpoint any one thing that could have happened. If we had only had some warning of the seriousness of the situation, if we had been lucky, we might have had a warning without a full disaster. But we had absolutely no warning, and this disaster hit us. If you recall, the following day there was a similar disaster in the chamber at Brooks AFB where two men were killed in an oxygen fire. Perhaps if the order of these events had been reversed, we would have been saved this tragedy because certainly we would have reviewed all the things we were doing.

After the decision was made to go to the moon, Bob Seamans gave a lot of thought as to how we should organize for it. Silverstein, I am told, took the position that if he were to manage the man on the moon program, he

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wanted complete authority in running the project. Mr. Webb wasn't about to give him that much authority. Bob Seamans made a trip to talk to me while we were located at LaRC, to see what I thought about who should head the program, how it should be organized, whether we could use a Lead Center concept, etc. I told him that since the program was such a large one, and obviously Marshall was going to be involved with the launch vehicle and we were going to be involved with the spacecraft and operations, that there should be a top man in Washington to whom we all reported. I thought Headquarters should not try to duplicate all the things being done at the Centers. It should be a fairly small group in Washington that made up in wisdom what it lacked in numbers, that it should act on policy matters, and not try to do the technical work. I think we had pretty good agreement on that. Headquarters hired Brainerd Holmes for the job in the latter part of the summer. Brainerd was a very personable young man with some experience in large electronic systems, but very little knowledge about vehicles or rockets or spacecraft; he learned very quickly. He and I had one very basic difference of opinion--he wanted a strong systems engineering group to use his term. Boiled down to its essentials, what he really wanted was a technical group in Washington that did all the things our Center did. Knowing something about management myself, I knew that nothing created more havoc than having two groups doing the same job. I told him I didn't understand what he wanted to do, and we had a fair amount of good natured exchanges over the subject, but it never did get resolved. He did bring in BellCom to do this systems engineering work, and in the years that followed, they developed a useful role in monitoring things done at the Centers and in making on the spot studies for the people in Headquarters.

But I believe we would have been able to get along quite well without that kind of a role at Headquarters.

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Brainerd brought with him a number of able people, and one of the most outstanding was Joe Shea. I also will always be grateful to him for bringing Jim Elms into the program. He felt I needed more management help here at the Center. I interviewed Elms in Washington and decided that as far as I was concerned he indeed could help. We later became close friends. He was very effective in helping us get organized in a way that allowed us to pursue the Gemini and Apollo programs. He came on board in late '62 and stayed with us through '63; during that short stay he sure accomplished a lot. Brainerd didn't stay with the program very long either. He left in late '63 and George Mueller replaced him.

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Every facility we have here at the site we felt we had an immediate need for, and in the last two-three years we have used every one to good advantage. The one I was a little worried about as not being perhaps as useful as it should have been was the vibration and acoustics test facility, and just how wrong I was is shown by the events of the last year when we really had tremendously important programs in both of those facilities. We have used them all--the vacuum chambers, the large centrifuge, our antenna test range--every facility we have at this Center and some we have had to "lash up,"--like the water hole over in one corner of the Center where we've made water impact tests of the spacecraft. We've had to improvise facilities for the Landing and Recovery Division to use for testing the spacecraft in rough seas and under high humidity conditions. We have improvised facilities that we needed to do the jobs that had to be done, and I am very proud of the fact we didn't build any facilities we didn't

need. I've always had a horror of building something that would be a white elephant. Faget, Aleck Bond, Dick Johnston and others deserve a lot of credit for the fine facilities we have. I think these facilities will all be very useful in future developments of space, and I can't think of one that won't have a primary role. I would like to add to this list the facilities at White Sands which have been absolutely essential in developing the engines for the SM and for the IM. The work there has been outstanding. Those are the only real space engine facilities of their kind in the country. They will have a good utility if we do anything in the future in space.

We've gotten fairly self-sufficient as a Center and I think that we've given at least as much as we've gotten from the other Centers. There have been a number of our people who have helped other Centers on problems. We've been glad to help Ames in developing their computer programs because we've got some darn good computer people here. It's been about even stephen; for example, we've helped Langley and they've helped us in developing gliding parachutes. We have a little different interest than they do, because we'd like to use the chutes, while their job is one of development. While our interests are different, the final result is the same, and we've worked together. We've also worked with Edwards. Edwards developed the lunar landing training vehicle which is something we have been able to use. They have also helped us on problems we've had in trying to make it safer. We've worked with Ames on problems of back contamination of the biosphere and the IRL. Dr. Kline of Ames and his people have worked with us on that. We are working jointly with the Electronics Research Center on such things as long life electronic components. We've assisted them

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on some of the Air Traffic Control problems that they have had. We are giving as much as we are taking at this time and I think that's the way it should be.

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The last year or so has seen MSC assign a certain amount of manned spacecraft work to Marshall. We were so heavily involved in Apollo that we were literally unable to find the manpower or resources to do all that needed to be done at MSC. We assigned to MSFC certain elements of the AAP program that we had been working on or started, such as the airlock module and the multiple docking adapter. Although the latter was a MSFC creation, it is a manned spacecraft in the sense that it will serve as a "wet workshop," or interim space station. We have to be realists and recognize that the Center cannot do everything. It is so heavily involved in the Apollo Program--we have the lion's share--and we have to be honest and recognize this fact and take the necessary steps to see that the work is done in the best possible way. In doing this by no means have we abdicated our interests in manned spacecraft or in future developments of spacecraft. The Apollo lunar landing program is simply such a tremendous program and it still has such a long way to go to completion that no other course is open to us.

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At Langley about 99% of the work was done by civil service people, except for the construction of large wind tunnels and buildings, etc. The idea of using support contractors the way we use them in OMSF was a new one to me and it's one I claim no pride of authorship in. It became the only way in which we could get the job done and I would say it has been a surprisingly effective way. It works far better than I would have thought it would. The contractor people can be highly skilled and highly motivated

and under proper conditions such as we have at this Center they are able to do an extremely competent job. There is a proper balance that has to be maintained between the number of permanent civil service people and the contractor corps. Of course there are some operations such as were performed in the old research centers back in the days of NACA where it was most economical for the Government to have 100% civil service staff. But in programs like Apollo that are dynamic, that grow fast and shrink fast--there will inevitably be need for support contractor type of activity.