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[full name of interviewee]

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MSC organization and operations.

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Masters 2

CONTENTS:

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

Education - _____

Career Path - ¹⁹⁵⁸ Lewis Research Center (Cleveland, OH); STG
(2 weeks); NASA HQ (6 yrs); 1964 MSC

Topics - ^{Bob} Gilrath role in STG + rift w/ Abe Silverstein;
error in making STG part of GSFCs; ^{STG} business
management reflect; Jan 1961 break w/ GSFC;
Lundin Committee on ^{STG location} ~~site selection~~; Apollo Program
announcement; new center planning; ^{Albert Thomas} politics
of site selection; initial reactions to Houston;
launch site decision - Merritt Island Launch Area (Kennedy)
launch vehicle assembly - ^{test ing} Michoud Plant + Mississippi
Test Facility; ¹⁹⁶¹ NASA Hq reorganization; Holmes as
Assoc Admin for Manned Space Flight; ^{PMSE} Management
Council (MSFC, MSC + KSC); b. Holmes exit;
MSC Deputy Directors - personalities & problems;
mistake MSC split operations & development; Hjørnevik
role; Early Apollo decisions; lunar landing decision
announced 4-25-61; on-going Mercury Prog (Gilrath)
(over)

decision for
lunar orbit rendezvous; ~~not~~ Apollo Spacecraft
Program; mistake of Hq program management;
Charles Fricke's downfall as Apollo Prog. mgr.
~~Apollo ASPO~~ position changes & personalities; ~~ASPO~~ ~~Program~~
~~Office~~ vs MSC 1964-66; Low relations
with MSC director Gilruth; Configuration
Control Board weekly meetings; weekly
meetings w/ project engineers; attention to
details; Mueller - Shea by passing
MSC management; NR role in Apollo Prog;
Apollo 204 fire; positive results;
Science at MSC; funding problems
for science programs; MSC technical
leadership role; Bob Gilruth role;
Low - Gilruth working relationship;
overall ^{MSC} team work w/ independent leadership.

January 9, January 14,

February 4, 1969

(George M. Low) 3

Space Task Group

My impressions regarding the formation of the Space Task Group may be a little different than those of others. I met Bob Gilruth for the first time in mid-September, 1958, when he was in Washington with Max Faget to put the final touches on what was to become Project Mercury. At that time I was assigned to the Lewis Research Center in Cleveland, and Bob and Abe Silverstein asked me to join Gilruth's team to justify Mercury. We settled the basic principles of Mercury and then convinced ARPA and NASA management to proceed in accordance with our plan.

On October 5, 1958, Dr. Glennan gave Dr. Gilruth the go-ahead to start Project Mercury. Bob went back to Langley and without much of any kind of charter started what was to become the Space Task Group. As far as I know, he wrote his own charter. He went to Langley Research Center and told them the number of people he needed, getting a few from Lewis also. Then he went to work. I spent about two weeks at Langley at that time, working for Bob, because that's where I wanted to be, but Silverstein immediately called me back to Washington. The job Bob had offered me, which I had accepted, was as Max Faget's deputy. This is a little known fact, because I was with STG for such a short period of time. I returned to Washington and spent the next six years as the individual in NASA Headquarters dealing most directly with the STG. I considered myself Bob Gilruth's representative in Washington and worked very closely with STG through the Space Task Group and Manned Spacecraft Center days until I joined MSC in 1964.

At least 90% of STG's job was to do Project Mercury. However, there were always a few people who worked on future programs.

Note: Items in brackets are for background only and are not to be used in MSC history without my expressed permission.

The Space Task Group was a highly technical organization which initially showed little interest in the business management aspects. Personnel management, financial management, etc., were handled on an ad hoc basis. The people were interested in the technical job and had little time for any more than that.

STG initially was an independent organization, reporting directly to Abe Silverstein in Washington, and became an element of Goddard Space Flight Center when that Center was organized. Bob Gilruth was designated an assistant director of Goddard under Harry Goett, in addition to being manager of Project Mercury. I feel that it was a real mistake even at that time to consider manned space flight a small part of a larger Center. I know it hurt Bob Gilruth very deeply to be named an assistant director of a larger laboratory, because he felt manned space flight was an element large enough in itself; but even if it weren't, and there was to be a spaceflight center of which manned space flight was only a part, Bob should have been designated the director. The plans for Goddard Space Flight Center had been developed before the size and impact of manned space flight were recognized, and Abe felt Bob had his hands so full with Mercury that he could not take on the additional job of organizing GSFC. The naming of Goett as Director of GSFC and Bob as an Assistant Director under him started a serious rift between Silverstein and Gilruth which didn't heal for many years.

The biggest mistake in trying to make STG a part of GSFC was that Goddard was several hundred miles away. This in no way influenced the technical progress on Project Mercury, but it made the business management job even more difficult. STG went through a series of personnel officers and financial management officers, all under GSFC's direction. At the same time, Goddard was trying to set up its own organization in Greenbelt, Maryland. As a result, for many years

STG did not have a good administrative organization and, in fact, did not really have one until Bob Gilruth asked Wes Hjernevik to join STG. Because of this lack of attention to the business management function, particularly financial management, we had to perform this task out of my office in Washington. STG just didn't have the capability to handle it in the early days.

MSC - A Separate Center

It became more and more obvious as time passed that manned space flight should be a separate entity, whether a task group, center, or what have you, but it was apparent that it should not be part of another Center. I had pushed for this since STG had been put under Goddard. The decision finally was made that the Space Task Group once again should become an independent agency, reporting directly to Silverstein, and that it should be broken out from the Goddard organization. This was in January 1961.

At this same time there were a number of committees created to investigate the manned space flight management role. These committees generally showed more interest in the medical aspects of manned space flight than Gilruth, I, or many others felt was needed, and as a consequence, they had a predisposition to link the Space Task Group with Ames. For example, there was a strong output from the Lundin Committee that manned space flight and Ames should be closely allied due to the fact that Ames was building a biomedical environmental facility.

(Lundin is now Deputy Director of OART.) The Lundin Committee's purpose was to investigate where STG should go -- whether it should be part of Langley, part of another Center, or an independent agency. I think it was the report of the Lundin Committee and the little pushing I could do behind the scenes which resulted in STG's getting its independence. I remember writing numerous papers for Abe Silverstein on the subject. It was apparent that STG should not be a part of Goddard,

but the question arose as to whether it should be part of Ames or of Langley. Our conclusion was that it should be an independent Center, located at Langley.

The idea to create a new Center, and its functions, was first spelled out in a meeting in Abe Silverstein's office in which Wes Hjernevik and I participated. It was at the time the Apollo Program was announced. I don't recall whether or not Bob Gilruth was there. Abe Silverstein stated that a program such as Apollo would only come along once in a lifetime, and only once in a lifetime would we have an opportunity to build a new Center like the Manned Spacecraft Center. We wanted a strong operational element but did not then decide that mission control should be in Houston. We wanted a strong project management group, astronaut support activity, and a major in-house test and development capability. (Silverstein has never been to the Center even though Gilruth and I have repeatedly invited him to MSC. We all know the Center was his idea.)

During this meeting Houston was also first mentioned. Abe had said: "I wonder where Albert Thomas' district is?" Wes told him it was Houston. We got out an old Rand-McNally atlas which Abe had, and one of the sites we looked at as a possible place to go was Ellington Air Force Base, Houston, Texas. We also looked at the California and Florida coasts. This was a spur-of-the-moment meeting to decide what we should ask for in the way of money for a Manned Spacecraft Center and to prepare a description of such a Center. If I were to give you the Center's functional description as developed at that meeting, it would probably still be valid today -- not the number of buildings, not the exact facilities, not the exact organization, but the functions described were no different than they are today. Whether or not the final selection of Houston for the location of MSC was a political decision, I don't know, as I was not involved in it. I know this was at

least one of the places looked at and recommended by the selection committee. I never knew whether this was their final selection or not or whether it was Webb's selection, and in spite of Abe's impulsive question as to the location of Albert Thomas' district and looking at Ellington Air Force Base, that was not how it was 'selected.7 Having lived here for five or six years, I think it was a good choice. That was probably Silverstein's last major contribution to manned space flight, the idea that a separate new Center should be built.

When the announcement was made at STG that the new site had been selected and that the Space Task Group would move to Texas, I was at Langley in a meeting and was present when Bob got the call from Washington, probably from Webb, so informing him. At the time, Bob thought it was a terrible idea -- and with good reasons. He was a project manager and had to move his group to Texas without even having flown the first orbital mission of Project Mercury, so it seemed an untimely action. If I'd been in his shoes, I would have been a lot more negative than he was. The one who probably saved the day was Shorty Powers. He put out an immediate announcement that Houston was a great place to live and an enthusiastic "let's all move to Houston and build a new Center there." Thus he adopted a very positive approach which helped instill this attitude in all of the STG personnel. I think Bob Gilruth will tell you himself that, once he had been to Houston and had seen the place and the potential for building a new Center here, he became one of the most enthusiastic supporters. He'll have to tell you personally when he switched from being negative to being positive.

An advance group moved to Houston very quickly with Marty Byrnes as its head. They found office space for various elements, and those elements that weren't directly involved with the immediate, ongoing Mercury Program (particularly elements of Apollo) moved to Houston at a very early date.

The Launch Operations Decision

At the time the decision to build the Manned Spacecraft Center was made, a number of other decisions of the same scope and magnitude were being made in NASA. For example, it was decided to launch toward the moon from Cape Canaveral (Cape Kennedy). The Kennedy Space Center at that time was called the Merritt Island Launch Area. The land was then purchased and the decision was made to use a vertical approach in assembling the vehicle and moving it out to the launch pad.

The Michoud/Mississippi Test Facility Decisions

The third major decision made at this time was that launch vehicles for the Apollo Program would be assembled at the Michoud Plant and would be tested at the Mississippi Test Facility.

NASA Headquarters Organization

During 1961 NASA Headquarters also changed its organization rather drastically. Headquarters brought in a Director of Manned Space Flight, D. Brainerd Holmes, who also was named Associate Administrator for Manned Space Flight, reporting to Dr. Seamans. The lineup in NASA Headquarters was Mr. Webb as Administrator, Dr. Dryden as Deputy Administrator, Dr. Seamans as Associate Administrator, and then a three-way split into Manned Space Flight; Science and Applications (unmanned space flight); and the Office of Advanced Research and Technology. Brainerd Holmes was in charge of Manned Space Flight, and his major function was to pull together the Apollo work of MSFC, MSC, and KSC. Marshall was a Center at that time, and what is now the Kennedy Space Center at that time was the Launch Operations Directorate under the Marshall Space Flight Center.

Brainerd Holmes formed a Management Council which involved the directors and deputy directors of MSFC and MSC and his immediate staff in the Office of Manned Space Flight. This council met monthly

to make the basic technical decisions in the program and to determine the responsibilities to be assumed by MSFC and MSC. Brainerd Holmes soon made the decision to establish KSC as an independent Center. MSC became responsible for the spacecraft, flight operations, and the astronauts; MSFC was given responsibility for the launch vehicles; and KSC, the launch operations.

As long as Holmes was with NASA he had two major elements in his organization, the systems organization under Dr. Shea and the program-oriented organization for which I was responsible. The systems organization tried to run the show technically from Washington; while on the program side we tried to function as we had in Mercury and Gemini, i. e., letting the Centers do the work with Headquarters merely bringing together their efforts and doing the things which needed to be done at a Headquarters level.

Brainerd brought a great deal of management competence to NASA. Through his Management Council and other devices he got MSFC, MSC and KSC to work together without a great deal of infighting or competition, which had previously existed. In general, the over-all relationship among the Centers was quite good. However, this was at the expense of the Centers' losing much of their independence. MSC was no longer responsible in Apollo for some of the things for which the Center had been responsible during the Mercury and Gemini programs.

Holmes was with NASA from late '61 to '63. It was under Holmes that the basic decisions for Apollo were made -- the kind of

booster, the kind of spacecraft, lunar orbit rendezvous, etc. I am not sure that these decisions would have been made any differently or sooner or later without Holmes, but certainly he was the man who was responsible at the time these decisions were made and should receive credit for them.

Holmes left NASA after a very significant split developed between him, on the one hand, and Seamans and Webb, on the other. He was replaced by George Mueller. I'm not sure I really know the cause of the split. I think Holmes wanted to have more responsibility and more authority than Seamans, Dryden and Webb wanted him to have. Webb and Seamans were trying to bring Holmes back to operating within the existing NASA organization. Holmes was not willing to do this, and it made the situation intolerable for both sides.

The Many Deputy Directors of MSC

When STG was first organized in 1958, Bob Gilruth named Charles Donlan as his deputy. Charlie did an extremely competent job of being Bob's "Mr. Inside" while Bob started Project Mercury. The Gilruth-Donlan combination was outstanding.

Walt Williams joined the Center about a year later, as a second deputy to Gilruth. Williams was deputy for operations, while Donlan was deputy for development. Walt was an outstanding man who was badly needed by the Center at that time. He had been at Edwards Air Force Base, knew flight operations well, and was the man to organize that element of the Center. /Unfortunately, for many reasons, one of which

was personal ambition, Walt eventually wanted to run the Center. He could just barely stand being the number two guy but didn't want to be an equal number two with anyone else, which made Charlie Donlan's job very difficult. In effect, he forced Donlan to leave. I guess if I were Charlie, I would have left, too.

With the division of the house into operations and development when Walt Williams came, there was a lot of "who does what" and jockeying for position, and Charlie just wasn't interested in that sort of thing. He had never had to do it before, and he didn't feel he should have to now. So he returned to Langley in March 1961. Walt then became Associate Director, a position he held until Jim Elms joined MSC in January 1963.

Bob Gilruth again asked me to join MSC before Jim Elms was hired. He was looking, with Brainerd Holmes, for another deputy to replace Charlie Donlan, and he asked me to fill that role. By that time, Brainerd had been onboard a year or so, and I would have been receptive to leaving Washington because I'd really learned all I would ever learn there and my contributions were becoming less and less significant, and I did want to get back to a field center. However, the job was one of being third under Walt Williams or, at best, co-equal with him, and for reasons I pointed out earlier I did not think that would be a satisfactory arrangement.

Both Bob Gilruth and Brainerd Holmes felt MSC needed a General Manager. They brought in Jim Elms from Ford Aeronutronic Division as a second deputy director of the Center. Walt Williams and Jim Elms were equal as deputy directors under Bob Gilruth. This was a very difficult situation. Jim was an outstanding manager and much more willing to fight for his rights than Charlie Donlan had been, but it was an extremely trying arrangement to operate. Operations and development were split into separate directorates.

Now the strength of MSC has traditionally rested on the fact that it is a combined operational-engineering-development Center. A split

between the operational elements and the engineering-development only serves to weaken the Center, and such a split existed as long as there were two separate deputies, whether they were Donlan and Williams or Elms and Williams. There might as well have been two centers, one for operations and one for development. Once that split took place, MSC as a single, integrated element ceased to exist. MSC was given a job in Mercury for operations and development. It carried it through in Gemini and in Apollo. I believe Apollo 8 worked so well because today Chris Kraft, Deke Slayton, Max Faget and I have an equal vote and receive an equal hearing for our viewpoints. There is no struggle between us. Williams was requested to join George Mueller's staff in Washington in 1963.

Elms was an outstanding manager and still is. He contributed a great deal to MSC, because he formulated the organization as it exists today. He got people working together. To make all of this come into being was difficult because of the rift that had grown, under Williams, between the operational and non-operational elements.

Bob Gilruth again asked me to join the Center in early 1964, as deputy director, after Walt Williams and Jim Elms had left, and then I did join MSC. I remained in this job until April 1967, when Bob (and Webb, Seamans, Mueller and Phillips) asked me to take over the Apollo spacecraft. George Trimble replaced me as Bob's deputy.

A word about how Wes Hjernevik came to MSC also is in order. When the decision was made to establish MSC as a separate Center, Bob decided he needed a strong Director of Administration. Al Siepert, then Director of Administration at NASA Headquarters, and I volunteered to find candidates for Bob. Wes Hjernevik, who was Siepert's deputy, threw his own hat in the ring. None of us had thought about Wes for this job. Bob had known him, and Floyd Thompson knew him, and Bob relied heavily on Floyd Thompson's advice. Thompson and everybody else said, "Go

get him." Wes joined the Center in April 1961, and he has been a major figure at MSC since that time. He built a strong administrative organization that was capable of doing the things that needed to be done. Recently he was named Associate Director of MSC.

Apollo - The Early Decisions

MSC's original work on Apollo was done by Bob Piland. Piland, working under Max Faget, pulled together the studies of the Apollo circumlunar mission. He had a small group within Faget's organization to get the Apollo circumlunar mission started and got North American and two other firms under contract.

I believe the impetus to make Apollo a lunar landing program, as opposed to a circumlunar mission, came primarily from me in Washington. STG did not play a strong role in planning that part of Apollo. Through the winter of 1960-1961 we completed a large number of studies that showed a lunar landing would be feasible in this decade. The success of Al Shepard's flight in May 1961, the phenomenal public interest it spurred, the availability of a NASA program to land on the moon, and the need of the Administration to have something other than the Cuban situation, the Bay of Pigs, etc. -- all of these things together made the time right to decide to go to the moon, and this program was announced on May 25, 1961.

When the Apollo lunar landing decision was announced, Bob Gilruth and I were traveling to Tulsa to speak at the First Symposium on Peaceful Uses of Space. Bob talked about Mercury at this symposium, and I talked about Apollo. In the middle of it, the President made his address to Congress, which was broadcast at the conference, and I was enthusiastic because I had been pushing for Apollo. Bob still was looking at what was left to be done in Mercury and felt it was too ambitious a step. You must remember that we still had not worked out the details on how to land on the moon.

Gilruth was so deeply involved in Mercury that he didn't show much interest in anything beyond Mercury at that time, which was understandable. I think Bob was a little bit scared of any bigger step than a circumlunar flight until we came up with the lunar orbit rendezvous technique. That technique was invented at Langley Research Center, not the Space Task Group. The question was whether we should use an earth orbit rendezvous mode or a lunar orbit rendezvous. STG, and especially Max Faget, originally were very much against the lunar orbit rendezvous mode. I had abandoned this approach in my Washington studies because Max was firmly convinced that technically it wasn't the way to go. Later, however, Bob Gilruth turned Faget around, and STG became an enthusiastic proponent of the lunar orbit rendezvous mode.

Once Bob was exposed to the lunar orbit rendezvous technique, he became convinced, for the first time, that the job really could be done.

It is important to note that MSC stood up for a technical belief and developed it technically to the extent where the rest of NASA felt compelled to go along with it. MSFC was the first to agree with MSC's approach, using the lunar orbit rendezvous technique to go to the moon. With MSFC and MSC pushing for it, Joe Shea and his staff pulled together the rationale for the decision and sold it to NASA's top staff and the higher echelons of the Executive Department.

The Apollo Spacecraft Program

The role MSC was to play in Apollo was considerably different than its role in Mercury and Gemini. In Apollo MSC was to be a third and equal partner under an over-all Headquarters Program Office, whereas for Mercury and Gemini MSC had been a lead Center with a relatively weak Headquarters organization.

Brainerd Holmes established that for Apollo, the Office of Manned Space Flight would be in charge and would direct the over-all program with each Center being responsible for its assigned portion of the program. In Mercury and Gemini MSC had been clearly in charge not only of the spacecraft but also the launch vehicle and the flight operations.

For the time period in question and the people involved in the program, this may have been the only way Apollo could have been handled. There was no way the launch vehicle people should be in charge of Apollo, but with the people involved I don't think it could have worked the other way. But Holmes made a very serious mistake in trying to manage too much of the technical detail of the program out of the Headquarters organization. He established a strong systems engineering organization under Joe Shea, with Bellcomm as technical support contractor, working for Shea. This organization tried to assume responsibility for the technical decisions in spacecraft development, spacecraft design, the over-all systems engineering, mission operations, and - in fact - all the things for which MSC had prime responsibility. It quickly became clear that this kind of effort from Headquarters, directed by people who did not have the experience that the people in MSC had, would not and could not work. I am not sure whether Brainerd Holmes ever really saw these difficulties, however.

If one could be all wise and could start Apollo over again, with the option of managing it through the Washington Program Office or using a lead Center approach, I guess it's still a tossup which would be most effective. Holmes was a manager who believed in management systems, management controls, and management tools. Up to a point, he was absolutely right. We did not have in Mercury, Gemini or Apollo enough discipline or enough of a systematic approach. Apollo was too big to handle on an ad hoc basis, but MSC and other people involved had been used to handling programs on an ad hoc basis. Perhaps we went a little too far from Headquarters in the kinds of systems imposed.

I mentioned earlier that Bob Piland had been the MSC sparkplug for Apollo. Bob, working for Faget, was responsible for the work during the initial study phases for the circumlunar Apollo program. He did a tremendous job. But both Bob Piland and Bob Gilruth felt that Piland should not

become manager of the Apollo Spacecraft Program Office. I think they felt Bob Piland did not quite have the maturity at that time to take on the job. As an aside, I might mention that this was another time I almost came to work for MSC. Bob Gilruth asked me to join MSC to manage the Apollo Spacecraft Program. This was late in 1961. At that time I declined the offer because I was the only one left in Headquarters with any continuity in manned space flight, and I felt obligated to stay with Brainerd Holmes and help him get started.

Bob Gilruth then asked Charlie Frick to take the job. Charlie had been at Ames, NACA, and then at Convair and had been designer or chief engineer on the Convair 880 and 990. Charlie joined MSC at Langley but soon moved his office to Houston. He played an important role in the initial organization of the Apollo Spacecraft Program Office.

There were two factors that contributed to Charlie's downfall. One was his effort to pull all Center activities into the program office; he tried to build another Center inside the program office, rather than making use of all the Center functions. It got to the point where the program office had little trust in the Center, but without the Center the program office couldn't function. Secondly, Charlie, who had been a very effective manager in industry, where he had direct management responsibility for the people who were doing the job, did not fit well into a role which called for managing industry. A great deal more tact and finesse were required, and it was necessary to worry more about people problems than he had while in industry. For both of these reasons he fell into disfavor with MSC management. Ultimately, he issued an ultimatum on some minor job -- either he would be allowed to do something or he would quit -- and when he wasn't given the permission he asked for, he quit. Both Bob Gilruth and Jim Elms kept me informed as the situation developed. I was at the Cape during the countdown of one of the early Saturn flights when Frick

called me to tell me he was being forced to resign, asking me what Headquarters was going to do about it. I informed him that this was an MSC matter, as he worked for MSC, and that he should settle his differences with them./ Frick also had two other factors to contend with: a contractor program manager who was difficult to work with; and the Shea/Bellcomm organization in Washington.

Bob Piland took over as Acting Manager of the Apollo Spacecraft Program when Frick left. /It was very clear that Gilruth and Elms still felt the job was too big for Bob Piland. Also, Piland did not really want it and doubted whether he could handle it. There was no serious consideration at MSC to give him the job./

One day, during this period, George Mueller, Joe Shea and I were in Huntsville or at the Cape, in a motel room, when Dr. Gilruth called Mueller to say that Bob Piland was overworked to the point where he had to have at least temporary relief or some of the responsibility taken off his shoulders. Gilruth asked Mueller to send Joe Shea to MSC to take over the Apollo Spacecraft Program. Both Mueller and Shea agreed.

Shea brought a lot to Apollo. He ran the office very differently than Charlie Frick had. He and Elms worked well together. /As part of the agreement to have Shea come to MSC, Mueller agreed that Williams would be moved to NASA Headquarters. Joe refused to come to MSC as long as Walt Williams would be in a role where he had any semblance of supervision over Shea. Joe had a great deal of respect for Jim Elms and Bob Gilruth but did not want to work for Williams./ Mueller brought Walt Williams to Washington as Mission Director at the same time that Joe Shea came to Houston.

Joe took over ASPO and by and large did an outstanding job. If I were to criticize anything he did, it would be his lack of trust in the operational elements and perhaps his lack of understanding of the operational elements of the Center. He fought too hard against Deke and his people, against

the astronauts, and against Chris and his people. He tried to do over within the Program Office those things that had been done, and should have been done, in the operational organizations. To a lesser degree this was also true of his relationship with E&D, where he bypassed the line management but worked very effectively with the subsystems managers. Nevertheless, he duplicated their work in ASPO and created some checks and balances over the work of the subsystems managers. If I were to point to one basic difference in the way Joe managed Apollo and the way I am managing it, it would be that I have tried to make Apollo a true Center program office with the Center running Apollo, rather than Apollo's being over and above the Center.

Let me be more specific on the problem of the Program Office versus the Center in the 1964-66 time period. The Program Office had TRW as its support contractor; on many studies, such as on sizing the RCS tanks in the Service Module, Joe had E&D do a study, TRW do a study, and would invite Chris Kraft's opinion. Perhaps, Faget or Kraft would recommend bigger tanks and TRW the reverse. This situation led to conflict between the Program Office and the rest of the Center because the Program Office had its own technical arm and could either agree or disagree with the Center as it wished. One of the first actions I took as Program Manager was to assign every technical support contractor working on the program to the element of the Center where the rest of the work was being performed. Thus I don't have a guidance advisor in TRW. My guidance people are the Guidance and Control Division in E&D, and TRW is now supporting them. The Boeing engineering support group also works for E&D except for the program control people who do work for me, but they aren't in competition with E&D.

There were things Joe tried to do which resulted in head-on opposition from the astronauts or Chris Kraft. He was unable to convince them he was right and could order them to do things a certain way only so long, since they are people who want to know why they are doing what they are doing; unless they understand, the organization and the work suffer.

E&D had a strong role in the beginning of the program, as it should have. FOD and FCOD - particularly their top people - got into Apollo too late. That was a real mistake, since they have a tremendous amount to offer. FOD has better systems engineers than E&D; in order to participate in flying a mission, good systems engineering is required. We have to rely on those men to look over our systems, find out what's wrong, and tell us how to handle them better. The same is true for FCOD. They are the users of the equipment and thus are an important element.

Bob Gilruth has said many times that one looks at a program differently if he has to do it, as opposed to just talking about it or planning it. Those who really have to do the job and meet the schedules and costs look at it very differently than the planners do. And those who must operate the equipment after it is built also have a different viewpoint.

It certainly didn't help MSC or the Apollo Program to have a Program Office which felt its job was to pick and choose from among several conflicting opinions coming to them from inside and outside NASA. What we've tried to do since I've been Manager of ASPO is make the Center work as I always thought it did and as Bob Gilruth wanted it to work, i. e., making each of the Center elements responsible for its role in Apollo.

Now there's no question in my mind, Chris', Max's, or anyone else's that they are being heard in every decision on Apollo. Many times their opinion is the one that carries. They also know that if their viewpoint doesn't prevail, I expect them to go to Bob Gilruth if they disagree strongly. We have today what we tried to build five or six years ago, a Center built to run a manned flight program and a Center that is running one. In every major decision I make, I ask myself, "Is that the way Bob would make the decision?" I am close enough to him and keep him well enough informed on what we do, day by day, that he would have every opportunity to disagree with me if he chose to do so. He seldom does, because I bounce enough ideas off him that they really are his ideas and those of his people which are going into Apollo.

The Configuration Control Board is the decision-making forum in Apollo. Every major decision made since I've been in Apollo has been made by me in front of the CCB. It was not made by the CCB, as the decisions have to be mine. I make them after hearing everybody's opinion for or against, but I don't take a vote on it. I make the decisions, and everyone knows that if he disagrees with my decision he should go to Bob Gilruth and tell him I'm doing something wrong, because I expect that kind of check and balance. However, in two years nobody has yet gone to Bob Gilruth. That doesn't mean we haven't had disagreements but just that they were never big enough to worry anyone.

The CCB meets almost religiously every Friday afternoon. Three Fridays a month, we meet at MSC, and on the fourth week we meet at the contractor facilities. Members of the Board are those involved in Apollo - Kraft, Faget, Slayton, Hess, Berry, Kleinknecht, Bolender and Simpkinson, Dale Myers from NR, and Ralph Tripp from GAEC. George Abbey is its organizer and secretary. Every significant decision -- and significant may mean changing the button on a toggle switch -- is made here.

Significant doesn't mean a lot of money nor a big piece of hardware; significant means that it affects the guts of the Apollo Program. It could be a toggle switch or the size of a wire; what's important is that it is significant to the well-being of Apollo. We usually have the top people in the Center at the CCB every Friday afternoon. Their deputies come if they can't, but we seldom see the deputies. Kraft hasn't missed five meetings in two years, and then only when he was on leave. That probably tells more than anything else what the difference is in managing Apollo now as opposed to two years ago. It is a Center program. Otherwise, program management hasn't really changed much.

I don't believe in systems. I believe in people who know how to do their jobs and are willing to do them. I didn't believe in a Control Room as

symbolic of a system and chart making, etc. However, I changed my mind, because I needed a communications tool, a way of getting together with the project engineers every morning to have them tell me what was going on and to permit me to help them decide what should be done. Thus it's a working control center where we meet for an hour and talk over today's problems, using the charts as guideposts.

I think we all know the importance of technical excellence. That has to be first and foremost; it overrides schedule and cost considerations. On the other hand, there has to be technical excellence with technical judgment. For example, I just talked with several people who wanted to make a change in the fuel cells, based on something that happened a couple of flights back. Technically they were completely right, but in light of getting on with the program, we decided not to make the change.

Tom Markley told me, one time, that he learned in Apollo after I joined the program that no detail was too small for me to worry about. Everyone who is now on the Apollo team is willing to worry about details, no matter how small. Again, that is what Bob Gilruth has taught us, and that is what is required in order to fly man in space safely.

Looking back, I now see that as Deputy Director I did not understand what was happening in the Apollo Program. I had worked very closely with Chuck Mathews in Gemini and knew how MSC and Gemini worked together. I didn't know enough about how MSC and Apollo worked together. I talked about it many times, but I didn't know how bad things were. Unfortunately, nobody told me, either.

Once I took over ASPO, it became very clear that things hadn't been running the way I thought they had, and I immediately set out to make ASPO and the Center one organization -- to have the key people in the Center and the organizations under them feel responsible for Apollo and participate in its management. I don't think this approach has vitiated

my role as Manager. I don't take votes, and I don't ask people to share responsibility with me if something goes wrong. I ask them to participate because I know they have something to contribute and I want their contribution. Apollo has to be part of the Center, and the Center has to be part of Apollo.

A major factor contributing to poor Center/ASPO internal relations when Joe Shea was running ASPO was Mueller's way of dealing directly with Shea, bypassing Center management. In effect, Mueller's direct dealings with Shea, and Shea's direct responses, cut Gilruth and me completely out of all Apollo decisions. I stopped this mode of operation the day I took over ASPO simply by asking Gilruth to return the first several calls I received from Mueller. Since then I haven't heard from Mueller. General Phillips' able leadership in Washington has also helped greatly in this regard.

From my experience at MSC and at NASA Headquarters I can't agree with the comment I have heard to the effect that NR runs the Program Office. I think NR has been less involved in running Apollo than McDonnell was in Gemini. In Gemini we really had a team of NASA-MSC and McDonnell. McDonnell was present at every meeting of any importance that Chuck Mathews had. Although they weren't running the program, they participated in every decision. If anything, when I came to Apollo, I saw far too little of the contractors. Today we have a much stronger NASA/NR/GAEC team than we had two years ago.

The Apollo 204 Fire

It is possible to look on the fire in different ways. First of all, it shouldn't have happened. It could have happened in Mercury or Gemini, but it didn't. Looking back, we did not do enough work on flammability in a 16 psi O₂ atmosphere; there's no question about that. By we, I mean the Center, not the Apollo Program Office. It wasn't we, meaning NR, either. It's all of us at MSC who should have done something about it. The fact that Apollo was an isolated program probably contributed to

how bad it got, how much velcro we had in the spacecraft, how much flammable material we had in it. But I won't say it would have been different if Apollo had not been an isolated program. I think we were extraordinarily unlucky that the fire started when it did. We had run many tests in that environment previously, and we'd never seen a spark or an arc or anything else. But it did happen.

Looking back over these past two years, aside from the fact that the loss of the three lives is something that is awfully hard to rationalize away or to be forgiven for, I think the fact that it happened and at about that time may have been just what will enable us to land on the moon in this decade. The re-examination of Apollo that came as an aftermath of the fire required us to build a different Apollo spacecraft; it created an entirely different atmosphere among ourselves, our contractors, and within MSC. I've talked about how MSC and ASPO are now working in Apollo as a team; that happened since and because of the fire. Our outstandingly good and open relationship with NR and GAEC has come about since and because of the fire. There's no question in my mind that everybody at NR wants to fly a safe spacecraft; that wasn't the case before. We weren't talking to each other before the fire. Relations had gotten pretty sour due to contractual positions, money, schedules, etc. Many things, such as the single point failures and poor designs which had been incorporated in the interest of saving time, and the arbitrary decisions by people who had not previously been responsible for flying men in space, were re-examined because of the fire. If it hadn't been for the fire, I am very much afraid we might have had a more serious accident in space.

Although we haven't yet landed on the moon, and though some presently unforeseen factor may still keep us from getting there, I think that, tragic as the fire was, it has made Apollo a much better program; perhaps

it has made Apollo the spacecraft that can land on the moon.

Did it need a fire to make it that? I don't know. It shouldn't have.

Science at MSC

Before I came to Apollo, I felt there were really two reasons to fly man in space. One was to take bigger and bigger steps, further and further in space -- going to Mars, to the planets, etc., for the sake of the advancement of technology. That's really what we've done so far; that's what Mercury, Gemini and Apollo have been about. The second reason was to gain new scientific knowledge, and I thought a good part of the manned spaceflight effort in the post-Apollo period should be devoted to this effort to gain new knowledge.

Therefore, if the end result of some future manned space flight is not landing on the moon but the data gained from the scientific payload -- and if MSC is to be directly involved in the end result of whatever is being done -- it is important for MSC to have a competence in science. That was how the Science and Applications Directorate came into existence. The people at Huntsville are satisfied to build bigger and better boosters to launch bigger and better things. But at MSC the transportation has always been the means to an end. The end has been landing on the moon, rendezvous, EVA, or something like that. So if the end is science, I wanted MSC to be part of that, too. That's why we looked for a Director of Science and got Bill Hess to join us. Unfortunately, since that time, we have lost people; we've lost the capability to expand as we had hoped to. We've not gotten the money we needed and the programs aren't moving forward as quickly as we had hoped they would. Right now, science has not built up as quickly as Bill Hess and I had hoped. I think it will still come, not with the future program but rather when we get the lunar samples back. It will be a tremendous boost for that organization. It will take a little longer than we had hoped, but since our future still lies in that area, it will continue to be an important element in the Center.

MSC's Technical Leadership Role

I believe Apollo could have been done better or easier if MSC had been a lead Center. With the personalities of the people involved, this may not have been possible. However, looking back on Apollo and on every major decision (and I guess I could say the same about Gemini), every significant decision stemmed from or originated at MSC. I have mentioned lunar orbit rendezvous. Although it was invented elsewhere, the impetus to include it in the lunar landing program came from MSC. MSC had a change of heart and became convinced that LOR was the way to go, then took the lead in demonstrating technically that this was the thing to do for the ongoing program.

The whole Gemini Program was an MSC invention. Chamberlin deserves the major credit for saying there should be a Gemini, but Bob Gilruth furnished the support in management circles. (Walt Williams was very much against Gemini and did not support it.) Bob Gilruth, Jim Elms (when he came aboard), and Jim Chamberlin were the sparkplugs behind Gemini. Without them there would have been no Gemini; and without Gemini, I don't know whether or not we would have had an Apollo. In Washington, Warren North (who was still in Washington) and I strongly supported Gemini; and among Gilruth, North and myself, we fought it through despite some very serious opposition from MSFC and some elements in Washington.

Later, on the issue of EVA in Gemini 4 instead of Gemini 5 or 6, with MSC's wanting the EVA on Gemini 4, Headquarters was negative and nearly killed it. The move to the MCC as early as we did in the Gemini Program was fought through by MSC over Headquarters objections. The most significant decision in Gemini, the Gemini 7/6 mission, was invented by McDonnell but brought to MSC's attention and pushed and sold by MSC. That was one of the most interesting management decisions made in the

entire Gemini Program. It took basically two days from the time Bob Gilruth recommended it to NASA Headquarters to the time it was announced at the White House. That's pretty fast.

Perhaps the most significant demonstration of MSC's technical leadership was Apollo 8. It was considered and brought into being by MSC in a way which put the Apollo Program ahead by about six months. We had to sell it to the outside world and to convince others that it should be done. Actually, Apollo 8 in general was very easy to sell to the other Centers, to General Phillips, and to Dr. Paine. But Mueller was very much opposed to it. There have been many other decisions - the way the Apollo missions should be flown, the sequence of missions, what each step should be -- and MSC has always taken the lead on these issues; as a Center it has generally prevailed, more often than not against Dr. Mueller's desires.

MSC is an equal partner among manned space flight centers since Brainerd Holmes' days, and we can point with a great deal of pride to the fact that every significant decision in every manned spaceflight program has either stemmed from an MSC-originated idea or an idea MSC has accepted and pushed vigorously.

The Director of MSC

MSC is Bob Gilruth's Center. He built it in terms of what he felt was needed to run a manned spaceflight program. Although we haven't talked a lot about Bob in the previous interviews, I think it's clear to all who have been associated with him that he has been the leader of all that is manned space flight in this country.

There is no question that without Bob Gilruth there would not have been a Mercury, a Gemini, or an Apollo program. Everything we've done, our approach, has grown out of the Bob Gilruth formula for running Project Mercury.

If you look at what is MSC, its strong and its weak points, MSC is what Bob wanted it to be and what Bob thought was needed to run a program like Apollo today. It's true that the organization has changed, that people have come and gone; but the people who are running the Center, who are making the decisions, who have had primary management roles in the programs from Mercury to Apollo, are those people who have shared Bob Gilruth's vision of what MSC should be.

Gemini perhaps is the best example. Gemini was Jim Chamberlin's idea; but without Bob to latch onto the idea immediately and to push it in NASA management circles, to insist that we needed to learn how to fly in space in applications more sophisticated than Mercury before attempting to land on the moon (all of which Bob said), we wouldn't have had a Gemini.

Or something like Gemini 7/6 -- it was someone else's idea, but as soon as Bob heard it, he moved forward with it and insisted this was the mission to fly, because it was obvious that this was what the manned spaceflight program needed.

Apollo 8 was the same type of situation. It wasn't Bob who thought of it, but as soon as it was presented to him, he said let's do it. If Bob had told me or anyone else that he didn't think we should do it, there would have been no question in my mind, in Chris' mind, or in Deke's mind, because we would have known that Bob had a good reason for not doing it.

I think one has to understand Bob Gilruth well before he can understand MSC. We have done either what Bob asked us to do or what we thought he would have wanted us to do. Bob is more of a leader than a manager. He has ideas; he inspires confidence and knows what's right and what's wrong; but he also expects the rest of us to originate ideas and carry them through to completion. Perhaps the greatest benefit I was to him

as deputy director was to follow through in those areas where the line organization didn't understand him well enough or wasn't strong enough to pick up the pieces on their own.

When Bob had a handful of people in STG, all reporting to him, the organization ran itself extremely well. When we became larger and larger, Bob needed a general manager, as he called me when I was his deputy; the general manager's role was to make the organization do what Gilruth wanted us to do.

More than any other Center, because of the kind of guy Bob Gilruth is, we have strong leadership people at MSC. Chris Kraft, Deke Slayton, Chuck Berry, Bill Hess, Wes Hjernevik, Bob Thompson and Max Faget are much more independent here than they would be at MSFC or KSC. Probably for that reason, as much as any other, we have better people than will be found at the other Centers. Every one of them has either grown up under Bob Gilruth or was selected by him to be part of MSC. Every one of them - and many of the people below them - are outstanding in their own right; yet they work well together as a team and have made Mercury, Gemini, and now Apollo successful.

All I have said does not describe MSC from the point of view of an organization chart. It's Bob and his people who make things go. Those of us who keep that in mind can keep it going; and it's only when a Charlie Frick or a Joe Shea comes along who hasn't been brought up under Bob and hasn't learned from him and tries to do things that won't work in the environment of MSC that we have problems.