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Oral history interview with Maxime A. Faget
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about Space Task Group
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[main focus of interview]

Apollo; Estab. of Manned Spacecraft Center.

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

Education - _____

Career Path - NACA _____

Topics - dev. of Mercury Program (initially ^{joint w/} DOD); ^{formation of} Space Task Group; initial ^{STG} recruitment; STG future programs; early ^{of orbit} lunar program ideas; Gemini Program; evolution of STG into MSC; new ^{MSC} center ^{for} developing + testing facilities; Systems Evaluation Dev Div (SEDD); MSC organizational changes after Mercury Prog; role of E+D; ^{prelate} ~~friction~~ between E+D + Apollo Prog; first impressions of Houston; MSC facilities; Choice of White Sands for propulsion testing; initial ^{MSC} organizational problems at White Sands; MSC ^{manned spacecraft} challenged by other centers + HQ; potential duplication of effort by MSFC + MSC

October 16, 1967

INTERVIEW WITH MAXIME A. FAGET

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I came on the Mercury Program when it started; as a matter of fact, I had been working on a number of the ideas that led into the Mercury Project. My position prior to the beginning of Mercury was with the NACA, where I was head of the Performance Aerodynamics Branch in PARD. The work there was basically doing high-speed aerodynamic research using rocket fired models. A great deal of this research was associated with ballistic missile heating during reentry and was corollary work, that is, it had to do with reentry bodies and things of that nature--a fairly natural background to the Mercury work.

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Prior to the formation of the Space Task Group, the summer of 1958 was used negotiating with the Air Force and the Department of Defense, over the relative roles of these agencies in what was going to be the Man In Space Program, eventually called Mercury. The NACA had established a number of joint committees with the DOD in order to coordinate the activity that was going on within the DOD and the anticipated activities that would take place in NASA, and one of these committees was devoted to man in space and I was the NASA representative on that committee. When the Mercury Program first started, it began as a joint program between NASA and the DOD inasmuch as it was governed by a board that oversaw the project and some money from the DOD budget went into the first years' effort. This approach was gradually phased out during the second year when it became quite clear that it was a NASA program both as to direction and as to financing. During that summer, though, there was activity organized back at Langley in support of the work that I was doing with the group. This was primarily

15 aimed at identifying a set of specifications for the man in space capsule. I spent about half my time at Langley and half my time at Washington.

✓✓ The effort back at Langley was organized primarily under Chuck Mathews and people from various organizations within Langley contributed to this work. When the Space Task Group was formed, these people plus some from Lewis who were doing somewhat similar activities were organized into the Space Task Group. I might mention also that at this same time we had a similar effort also under my direction going on identified as the Scout Program. There was some early consideration given to including the Scout project under the control of the Space Task Group; however, it was decided that this would dilute the Mercury effort and the Scout program was left within the Langley Center Organization.

✓✓ When the Space Task Group was first organized, three divisions were created. One of them was Operations, under Chuck Mathews; another one was Flight Systems Division, which I was the head of, and the third was I believe called Engineering and Contracts Division, under Zimmerman. The Flight Systems Division was primarily in charge of identifying the requirements and the detailed specification and design of the flight hardware. The Operations Division was charged with the responsibility of creating an operating organization, and the various ground facilities that would be required during the operation--that is, the ground network, the control centers, and things of that nature. 45-1 The third division dealt primarily with the contracts and the business aspects of the contract and administrative aspects of the Space Task Group itself.

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Obviously the first year or so in the Mercury Program was one of extreme activity. We not only had to get the contractor underway building the spacecraft, but we had to identify the complete flight development program and ground test program leading up to flight. We had to negotiate with the various DOD groups for launch vehicles and for support of launch and flight operations. There were just a great number of things going on. From the very beginning, we were hampered by a lack of people. Time and again, we went to Headquarters, asking for more people. We were given a fairly good sized beginning allotment--something like 100 or so billets to recruit against. We just got a fairly strong recruiting activity underway and people were just beginning to commit themselves to join us, 29 when this all got turned off by some move at Headquarters which reduced our strength. This happened several times since then. It has been one aspect of management effort to keep momentum underway on recruiting.

30 One of the fortunate things that happened in the early days was when the Avro Arrow was abandoned by the Canadian Government and this freed a great number of Avro people. A special recruiting effort went on there, which I didn't take part in, but I guess maybe 40 or 50 percent of the people that were recruited joined my organization. They came on at a very timely period of our development. Another saving thing that happened, was that during the time period around June, 1959 the Langley Research Center found itself overcommitted on new college hires by a great number and this 29 happened just as we received a commitment from Headquarters to increase our strength. As a consequence, we were able to make a deal with Langley where we accepted a great number of these college hires. It also happened to be one of these years when the NASA was able to hire some of the better

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people out of the Universities, and we got an excellent group of people that way. However, they were raw. We set up a special training program within the Space Task Group to bring these people on as fast as possible. Purser and myself were deeply involved in getting this instituted. Many of those people that were hired at that time are now branch heads throughout the organization.

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I might mention that in the immediate flurry of activity, getting everything started, that some organizational conflicts developed within the Space Task Group between the three divisions. I'm not sure that any organization is without conflicts. The role of the divisions relative to development and operational aspects of the spacecraft was never quite adequately clarified. The operations people felt completely responsible for the spacecraft when it was flown, whereas the development people had the attitude that they had responsibility until it was completely developed, which included flight operations. This resulted in some conflicts. Also, Operations felt like if they were denied a part in the development effort that they would not be a strong organization and they made a stated and conscious effort to participate in the development of the spacecraft which was all right, except for the fact that the responsibility for any particular piece of development sometimes got confused. Eventually the Engineering Division did the same thing. Its people always played a fairly strong part in the structural engineering of the spacecraft where the Flight Systems Division primarily was responsible for all the different systems aboard the spacecraft. The conflicts between Engineering Division and the Flight Systems Division grew worse after Zimmerman left and was replaced by Chamberlin in the Engineering Division, primarily because Chamberlin had been a pro-

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gram engineer at Avro and was oriented more towards direction of the project than playing a supporting role. Or that seemed to me to have been the reason. Eventually it all settled down and we ended up creating a project office under Chamberlin and gradually evolved the present orientation between the different organizations that we now have, where the Apollo Program Office is supported by the Engineering and Development groups and the expertise remains in the Engineering and Development and as the program direction remains with the Program Office.

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Near the end of the big effort on Project Mercury, as far as development work was concerned, the Space Task Group started looking towards doing new projects. In fact, after the Space Task Group was about a year old, I had Kurt Strass working solely on future programs with two or three people helping him. Meanwhile, NASA Headquarters had set up a group under GoETT Ghett which was looking at this same problem. Now, you will recall that Ghett was our Center Director, being the Space Task Group was part of Goddard. The so-called "Ghett Committee" looked into the feasibility of a Lunar Program. The main concern of Dr. Ghett during this period of time was whether sufficient guidance capability would exist to make this program feasible and I think fairly early in the meetings of this group, the people from the Space Task Group (who never were concerned about guidance) finally convinced Dr. Ghett that he could stop worrying about guidance accuracy. (He was worried about whether or not we could actually get in the corridor. As it turned out, not only is it easy to ^{guide into} get in the corridor, but I think the L/D requirements are about a quarter as much as ^{We} ~~he~~ thought we would need.) Anyway, between the work that Strass was doing

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and the ~~Ghett~~^D Committee, I think that was the primary effort in looking to the future during that time period.

64 Along about the year or so before we left to come to Houston, we were getting more and more interested in the next mission. We were encouraged in this by the fact that Marshall and NASA Headquarters were talking about a new generation of large boosters and we were trying to capitalize on the lifting capabilities of these boosters in a program that would match that capability with the most severe set of mission requirements that we could accommodate. Our first thoughts about a lunar program at that time were limited primarily to Lunar Orbital Flight with the thought that perhaps someday that type of program might be extended to a Lunar landing. During 1960, I believe, we created a much more comprehensive effort under Bob Piland for advanced programs and actually let the three study contracts which led to the Apollo Program, to Martin, GE, and Convair to study the spacecraft design for a lunar mission. Again, the primary emphasis was on Lunar Orbital flight with possible extension to a landing and also with the idea that there would be alternate missions with the same hardware such as the Earth Orbital Laboratory Missions. This effort culminated at about the same time that President Kennedy made a decision to establish Apollo as the lunar landing program.

64 During the fall of 1960, at the time when Dr. Glennen was a lame duck head of NASA, a young Turk group (if you want to call it that) within the NASA organization were promoting another manned spaceflight program to come on after Mercury. This program primarily evolved around the idea of earth-orbital laboratories and lunar orbit flights. Dr. Glennen made it real

clear that he did not support such a program; however, he also made it clear that he would tolerate a certain amount of effort towards defining it, provided that it was not made obvious that NASA was getting involved in these things. In consequence of this, the Low Committee was set up to define what might be required in the way of boosters and so forth in such an effort. This committee was run by George Low who was working for Abe Silverstein in Headquarters and was in charge of manned space flight.

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During the year 1961, something happened in the Space Task Group that was pretty important--the creation of the Gemini Program. At the same time we were concerned about Apollo, we were also concerned about extending the Mercury spacecraft in ~~other~~ missions where possible. The thought was to possibly do longer flights in earth orbit, maybe three or four days instead of just one. McDonnell had done a number of studies, primarily by extending the mission period with a small external module that would provide extra life-support equipment and storage ^{for expendables} for extended duration of the mission. During the summer of 1961, Chamberlin got sufficiently interested in this work, that he spent a period of about six weeks at St. Louis working with the McDonnell contractors looking into the feasibility of an improved version of the Mercury capsule. The changes that came out of this were sufficiently great that it seemed appropriate to consider the thing a brand new program. I suggested that as long as they were going to make a new program they ought to put two men into it, instead of one and this suggestion was implemented. The final outcome was as proposed: that we have a two man spacecraft boosted by the new Titan vehicle. (Titan II was becoming operational at that time, and Gemini took advantage of all

the advances that the Titan II offered as well as the improved reliability.) There was developed within this Space Task Group, as a result of this decision, a conflict between the Apollo and the Gemini Programs, the concern being that a full scale effort on Gemini would reduce the ~~capabilities of~~ *resources available for* the Apollo Program. Nevertheless, Dr. Gilruth strongly supported the Gemini Program. I got the impression that Silverstein himself was opposed to Gemini, but I'm not sure about this. I know he was opposed to it to begin with, and I'm not sure whether he ever changed his mind. I kind of think he remained opposed to it. However, Dr. Gilruth was able to sell it to Dr. Dryden and Mr. Webb. Along about this time the Space Task Group was divorced from the Goddard Space Flight Center. Being part of the Goddard Space Flight Center in such areas as control of resources, personnel, promotions, and all of the various administrative procedures that were part of the Goddard Plan was always a handicap for Space Task Group. The Space Task Group was always treated as a poor cousin. The biggest building at Goddard right now ~~is~~ *was justified into the budget as* the Manned Spacecraft Development Laboratory.

At the same time that this happened, of course, there was a pretty big
 (08-1) conflict up at NASA Headquarters on how this Apollo Program was going to be run. It became apparent at the onset that it would not be run like Mercury where one Center was put in charge of the Program and the other Centers supported that Center. On the contrary, the program was going to be run out of a program organization setup in ~~NASA~~ Headquarters and the main consideration immediately became how much authority was this program office going to be given, what would be its charter, and who would run it.

[Again, just from my viewpoint, I got the impression that Dr. Silverstein

thought that he ought to run it and that he thought he ought to be given complete control of the program. He proposed to run it this way and as a consequence of taking that position, he ended up going back to Lewis. I think he negotiated this proposal on a take it or else basis, and he ended up with the or else.] After that, Headquarters decided that it would create the organization and decide how much power it should be given and then find a leader. As a result of this, the Office of Manned Space Flight was created and Dr. Brainerd Holmes was brought on as its first head.

[Brainerd Holmes came to visit the Space Task Group as one of the first things that he did. He made a little speech to its people and ended up by saying that he was here to do the job, and he wanted us to know that we might work together easily or with some difficulty, but after he left, we'd know that he had been there. I think that it would have been mighty nice to have that recorded because it seems that at this time very few people remember that he ever was around.]

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During the summer of 1961, there was great conjecture over what was to become of the Space Task Group--whether indeed it would become a new Center and if it was a new Center, where the center would be located. There were many wild rumors--we would be made part of the Ames Laboratory; part of the Langley Laboratory; we would build a new laboratory some 10 miles away from Langley; we would go to some existing Air Force or Navy facility that would be turned over to us by the present occupant. One of the considerations that led to the desire to stay in the Virginia area was the great amount of support we were getting from the Langley Laboratory in the way of test facilities and various base support functions. Once the

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190 decision was made that we would set up a new Center, the function of the Center had to be decided upon. Dr. Gilruth indicated at the beginning that he wanted a strong technical supporting organization in being at the Center, with laboratories that would essentially support all of the various developments required for manned space flight. He asked me to be the head of this part of the organization. I was assisted in the planning of the engineering laboratory at the Center by Aleck Bond, Joe Kotanchik, and Ralph Sawyer. I might mention here from an organization standpoint that along about this time I heard that Chuck Mathews was no longer going to be Chief of Operations. Walt Williams, in addition to being Deputy Director, decided that he would be the acting assistant director for Operations as opposed to promoting Chuck into that job and that essentially left Chuck without a job. I asked Dr. Gilruth if it would be all right if Chuck would support me in my work. He agreed, and Chuck was apparently happy to do this, so when we first moved to the Manned Spacecraft Center, Chuck Mathews became my Deputy.

146 In planning the new facilities for the Manned Spacecraft Center, we decided that these facilities would encompass all of the developing and testing facilities required for various spacecraft systems and would also include certain large unique facilities that would be required if this country were to develop a ground test capability for Manned Spacecraft. These facilities would be those that you identify as being too expensive for any one company to build on their own and thereby would be more or less as National facilities. These include the space environment simulation laboratory, the centrifuge facility, and I think we also considered the antenna test range in

this category. We debated quite a bit on whether or not the Center should have any aerodynamic facilities and ended up deciding at that time (and several times subsequently when the issue was brought up) that this Center would not have aerodynamic facilities but would depend on other NASA facilities or non-NASA facilities throughout the country to do the aerodynamic testing required for manned space flight, inasmuch as a great number of these facilities were in existence, and some were even getting phased out because of the lack of work. The two biggest facilities that were considered were, of course, the space chamber and the centrifuge and I think these were specially identified in the initial construction budget of the Manned Spacecraft Center.

190 When we first moved on the site, there were three divisions under the E&D Directorate. One of them was the Flight Systems Division which was run by Chuck Mathews as acting division chief, another was the Systems Evaluation and Development Division which was run by Aleck Bond, and the third one was the Crew Systems Division which was run by Dr. Stan White. Under Aleck Bond's division, I put all of the facilities for the site. Their main job was the test, evaluation and development of hardware, whereas that of the Flight Systems and Crew Systems Divisions was primarily one of analysis and project expertise in the systems for the support of projects. During the first year, SEDD spent a great majority of its time identifying the various new facilities that would be required on the Center. These included the facilities that now exist under the IESD, under Structure and Mechanics Division, under PPD, and also the centrifuge. Inasmuch as the people in E&D who had experience with large facilities all

existed in Aleck Bond's division, I made a decision that the centrifuge would be under that division, at least until it had completed design and construction. Later on, it was turned over to Crew Systems Division for operation. The Guidance and Control Division, however, came out of Flight Systems Division and their laboratory was developed as part of that division.

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Shortly after we arrived at Houston, Walt Williams decided that we needed another Assistant Director because he felt that there ought to be a closer tie between those electronics that had to do with the operations facilities and those electronics that had to do with the spacecraft. He brought Barry Graves on to head up this new Directorate. He also, at the same time, created a ground systems program office which would direct the development and installation of the mission control center at Houston. Barry Graves was put in charge of this at the same time. The consequence of this move was that the Electronic Branch in SEDD was transferred to Barry Graves along with certain parts of the operations directorate. I personally think that this was a mistake and it later was reversed when Jim Elms replaced Walt Williams. Paul Vavra came on as an Assistant to Barry Graves for the Ground Systems Project Office.

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From the start, Barry Graves' efforts were in conflict with those of Chris Kraft and my own in many areas, because of dual responsibilities. Kraft's people resented a special program office being set up outside their control for the purpose of creating their facilities and I guess we didn't like the idea of being denied the control and responsibility of part of the spacecraft hardware, just because it was electronic as opposed to something else.

Jim Elms and Walt Williams were put in positions of equal responsibility, both being Deputy Directors. Walt Williams had the ^{Mercury Program Office, the} Ground Systems Program Office, the Barry Graves line organization, and the two operation directorates, one under Slayton and one under Kraft. Under Jim Elms went the ^{Gemini} Program Offices, the E&D organization, and I don't remember whether Hjordnevik's organization was shared by Elms and Williams or was mostly under Elms. I believe one version showed it split. ^{Apollo and}

A cautious peace existed between these two organizations, and continued until the time the Mercury Program started phasing out. The Mercury Program Office was put under Walt Williams because it was in an operational phase whereas the program offices such as Gemini and Apollo at that time were under Elms because they were in development phase--I think that was the understanding. Well, when the Mercury Program Office came to a conclusion, the question came up as to what would be done with the people ~~in~~ ⁱⁿ the Program Office. Two things could have been done with them. They could have been divided and dispersed into existing organizations or a new organization could be created for them. Walt Williams favored creating not one but two new directorates with these program office people in them. It ^{was} ~~is~~ quite apparent that the purpose of these two directorates was to give Walt Williams control over the development effort. They were to have oversight over the development work program offices were doing, ^{as well as implied veto power.} This organizational concept was pushed very hard by Williams and ~~I guess~~ it was opposed by Elms; I know I opposed it strongly on the basis that an organization where people without responsibilities had the opportunity to kibitz what others were doing was bound to make for a very unhappy Center.

Along about that time Walt Williams got promoted to Headquarters. He stayed up there a little while and then quit.

As soon as Williams left, Jim Elms became the sole deputy to Dr. Gilruth and set about reorganizing the Center, along the lines that would produce less conflict between the various elements. As a result of this reorganization, the Ground Systems Program Office was terminated, the directorate under Barry Graves was eliminated, and a better understanding of roles between E&D and the Apollo Program Office was created. Barry Graves became my Deputy replacing Chuck Mathews who had become the Manager of Project Gemini several months earlier.

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It had been the traditional role of E&D to try to identify the concepts for new programs and projects, prior to their inception. We did this in both Mercury and Apollo. During the first year we were in Houston, the argument over whether we would go LOR or EOR was settled with the idea that there would be a LEM in the program. The Flight Systems Division under Chuck Mathews did all the systems engineering for the Center in establishing the superiority of the Lunar Orbit Rendezvous Mode, and subsequent to the decision to have a LEM, They were then given the job of the pre-proposal specification work and conceptual design work all of which was carried out under Chuck Mathews. The Program Office was under the direction of Charlie Frick at that time with Bob Piland as Deputy. Piland's job for a while there was to concentrate on the LEM and to work with Mathew's Division from a Program Office standpoint. In regard to the relationships that existed between E&D, the Apollo Office and the Gemini Program Office during the first year in Houston, the Gemini Program was

252 established primarily as an MSC alone program as opposed to one that was involving many elements of NASA as Apollo does. Therefore, there was not strong direction from Headquarters for Gemini. In addition, the majority of the detail design features of the Gemini project were conceived and decided upon between Jim Chamberlin and McDonnell Engineering Company. During this period the elements of E&D were not consulted or asked for help. As a consequence, the reasons behind a number of the design features were not well understood by E&D, and I guess the consequence was that some of them were not appreciated. On the other hand, ^{most} ~~all~~ of the basic features of the Apollo program were either created within the E&D organization, or ~~at least~~ concurred in, and at the very least were well understood even if they were not concurred in by the E&D organization. 268-1 Essentially E&D participated in arriving at the many many detailed features of Apollo even though they may have originated at North American rather than the Government. The relationship between E&D and the Apollo Program Office was therefore a much closer one. However, there were great conflicts. The head of the Apollo Program Office, Charlie Frick, played a very strong role in the program. In the early days of Apollo, the Apollo Program Office judged debate between the Engineering Group at MSC and the Engineering Group at North American. When a problem was identified or some detail in the Engineering aspect had to be decided, North American would propose a way to do it, perhaps E&D would propose a different way to do it, and the Apollo Program Office would sit in judgment. 253 191 This was really not too good a way to do things. All this sounds like things were confused; actually, things weren't really that bad, but there were conflicts between the organizations. As the Gemini Program matured,

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the Gemini Program Office grew, and became pretty much self sufficient as far as the engineering detail was concerned. In the case of the Apollo Program Office, the Apollo Project was vast compared to Gemini, the contractor was inexperienced, and there was a real strong need for the Apollo Program to get support from the Engineering and Development Directorate, When Jim Elms reorganized the roles of these two groups, he made it real clear that the Center would organize its expertise in the various systems within E&D transferring people if necessary to get this expertise placed there, that the program offices would recognize where the expertise lay, and when it came to technical advice, they would recognize that the best technical advise and consultation would be from these people. On the other hand the relationship was such that control of the program was clearly understood to be within the program offices. This resulted in a better relationship between the E&D Divisions and ~~Gemini~~ ^{Apollo} inasmuch as attempts from ~~Gemini~~ ^{Apollo} to get support from E&D took place along the lines that were fairly clearly understood.

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My impressions of the general Houston-Gulf Coast area were formed as a result of several trips down here before we actually moved. I was personally very pleased with the place. I guess like all of us I was kind of negative on the idea of having to move at all, but once the decision was made to move, I started looking into what life would be like here. I've always liked a warm climate and I enjoy water sports. From the standpoint of recreation I don't think we could have found a more ideal location than we have here. I also was pleased to find that housing would be relatively easy to come by and quite a bargain. I was quite pleased to find that the Houston area was attractive to other employees and moving to

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Houston greatly facilitated our increase in staff. At the time of the move we were also building up our staff. Several months before the move commenced we began hiring on the basis of location in Houston as opposed to not knowing where we were going to locate. We ^{noticed} ~~experienced~~ an immediate increase in the acceptability of employment. In other words, people were much more willing to come to work for us. Not only Texans, but others as well, located around the country who had been waiting for an opportunity to both work on the space program and work in Texas. People who had never thought of living in Houston found it an easy place to move to. I personally ended up living in Dickinson. I think that the reason that I did, was that I wanted to live on the water. I found my lot on the bayou. I also felt like I would like to avoid living in one of the new built up areas that would be dominated by NASA people inasmuch as I felt like my home life ought to include a wider variety of friends.

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When we first came to Houston, facilities were a primary problem. It was a general problem just from the standpoint of housing all the people and the Manned Spacecraft Center ended up leasing a great number of different office buildings in the general Gulfgate area. For E&D the problem was doubly severe because we needed both office and laboratory space. We ended up with a fairly large laboratory building, on Telephone Road. It was converted from a manufacturing plant for fans. There were other locations such as the one that Crew Systems Division used and which was rented from Dresser Industries. It was a nice place and already had separate office and laboratory areas, all in one location. At the same time we were implementing temporary laboratory and office facilities we were planning the permanent facilities for the site, and as I said before, this responsibility

was delegated to the operating divisions. They in turn used their supervisors to identify the type of facilities that could best carry out their roles, or their intended roles once we moved into the site. I think we did fairly well in all of the various fields except perhaps for Propulsion. In the case of the Propulsion people, we immediately set up temporary test stands at EAFB and put them in operation. At the same time we were planning the Thermochemical Test Area. We had to make a decision, however, on location of test stands for the main propulsion systems for the LEM ascent and descent stages and the service module propulsion system. We made a survey, unfortunately at the wrong time, because the Air Force had just come out with some ^{absurd} standards for test facilities using hypergolic propellants similar to ^{N₂O₄} UDMH and hydrazine. The main criteria was based on the toxic aspects of these propellants. Both propellants tended to produce heavy vapors which cling to the ground if they are spilled and drift with the wind for fairly long distances before they get diffused sufficiently to be considered safe from the toxic standpoint. Considering the quantity of propellants that would have to be kept in storage and used in any testing program, various estimates were made based on the Air Force-developed criteria on the degree of isolation required for the facility. A gross estimate indicated a ten mile zone surrounding the facility was needed to provide the ideal safety requirement. Consequently, the thought of locating that facility on the site was abandoned immediately and other locations were considered. Subsequent to that time, a great number of facilities using essentially the same propellant and in the same general quantities were located in areas that are no more isolated than our own here at the Manned Spacecraft Center. In other words, if we would have

been able to make our decision a year or so later, we would have been able to justify locating the test stands here in Houston. The people who make our various propulsion systems, Bell, Rocketdyne, TRW, and Aerojet facilities all are located in areas that I think are equivalent in the degree of isolation which could be attained in the back area of our Center here.

They achieved this by design which essentially says that all propellants they have available aren't going to be spilled all at once. The spilling is going to be eliminated by various safety features that they could put in the transfer lines and other areas, as opposed to assuming that all of a sudden the whole tank is going to open up and flood the place. Nevertheless, at the time we had to make the decision, and we automatically precluded our own areas as a candidate. ^W We were therefore forced to consider other places and the other places included some locations in Texas, such as the Padre Island area; McGregor, Texas where Rocketdyne had some of their rocket facilities, which I never visited and I don't know much about; the White Sands area, (both White Sands and Holloman) and Eglin AFB. After considering all of them with their various features which included degree of isolation, the ability to hire people, in the area, etc., the choice narrowed to either the White Sands area where we are not located, or Eglin. [I detected the subtle hand of the Senator from New Mexico playing a role in the final choice--that of course is off the record. Nevertheless, all of a sudden it became quite obvious to people at MSC that if we decided in favor of White Sands, it would be fairly easy to get concurrence at Headquarters.]

Actually, we found the Army people at White Sands were a lot easier to

deal with than the Air Force people at Eglin from the standpoint of their willingness to deed over the property and accept the complete NASA dominance of the facility. The Army was willing to give us a vast area near White Sands with essentially no restrictions on our control of activities in the area. The Air Force was willing, as near as I could tell, to meet all of our demands, but not quite in as generous a manner. So, it was decided that going to White Sands really wouldn't be that painful. I must also admit that I was prejudiced in favor of White Sands as opposed to Eglin, because I feared that the Marshall Space Flight Center would eventually capture a facility at Eglin. From the standpoint of location there were rumors that as soon as we got the facility going, Marshall would say, why don't we take over the administration of the facility because, (1) we are basically rocket people here and we know how to run these kinds of facilities, and (2) it's a lot closer to us than it is to the Manned Spacecraft Center. Actually, from the standpoint of distance, both Eglin and White Sands were about the same distance from Houston; however, White Sands was a lot further away from Marshall than Eglin, obviously.

It was unfortunate that we did not locate the facility here in Houston.

369 Now that the test program at White Sands is terminating, it is going to be very difficult to see how we can continue that facility as an economical operation. If located here close to our R&D engineers, ^{research and advanced development} ~~this type of~~ work would be a lot easier to do. Because the nature of R&D work the engineers that are directing it feel like they have to be very close to the activity. They have to get immersed in it, ^{where} they have first hand experience with what is actually going on in order to provide the best lea-

dership to the development work.

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White Sands encountered a great deal of organizational problems. [When it was first set up, Charlie Frick stated the intent of having it as his own private little test facility reporting directly to the Program Office. It turned out that at the same time Frick was planning to work this way, Walt Williams was planning it to be his own private little R&D facility operated by Operations people. He was planning on using Gemini people and other Operations people such as the ones at the Cape that he felt were under his direction and would do his bidding.] When it finally came to actually staffing the facility, we went through a number of other possibilities. One was that the whole White Sands area would be under E&D as just another development facility. It would be an extension of the types of development facilities that were here on the Center, and actually it would be part of the Propulsion Division, similar to the Thermochemical Test Area. There was a short period of time when the White Sands was actually under the command of three different offices. The propulsion and test area was under the Propulsion Division, and the people out there were a separate branch of the Propulsion Division. The LITTLE JOE Flight Test Program was part of the Apollo Spacecraft Program Office, and their leader was one of their branch heads of something like that, and at the same time the base itself had a man that reported to Wes Hjernevik as part of the Administration Directorate. We had a triumvirate trying to run things. This did not work. The situation was saved when we hired Marty Raines to run the place and arrived at an understanding of how we would operate it. It was agreed that Marty Raines would run the base and that

the test stands would operate on programs that were established and controlled by the Propulsion and Power Division. The launching would operate on programs that would be established and controlled by ASPO. All of these things would be done directly under the supervision of Marty Raines who would be responsible for the day to day activity out there. This has worked out very well.

31 One of the fundamental concepts of the Manned Spacecraft Center was that manned spacecraft development would be managed by the Manned Spacecraft Center. I think from the very start, the idea was of concern to a number of outside groups who realized what a big piece of the total NASA pie manned spacecraft development and operation really amounted to. Ever since its inception the Manned Spacecraft Center has been under a continual challenge in its role as the development center for manned spacecraft.

These challenges have come from many directions. Early in the program, the Lewis Research Center tried to get a piece of the action. They tried to lay claim to the Lunar Descent Stage as part of the original earth orbital rendezvous concept and in this case, a very large hydrogen and oxygen descent stage was visualized as the propulsion system that would decelerate the spacecraft into lunar orbit and subsequently carry the spacecraft down to the lunar surface. What is now the service module would be the ascent and return stage, and in this ^{concept,} ~~case~~, the command module actually descended to the lunar surface. This greatly worried the management at NASA and at MSC it undoubtedly rankled to have part of our birthright taken away from us right at the start of our existence. It also deeply concerned us because we felt like this descent propulsion system was in-

timately part of the total spacecraft that went to the moon, that the descent propulsion system was under the direct control and operation of the spacecraft crew. ^{The} ~~and~~ interface between the spacecraft and the descent propulsion system was very complex ^{with multiple} ~~and its~~ interactions, ^{The} ~~as a~~ separate development of these components by separate Centers would create almost impossible interface problems. Nevertheless, Abe Silverstein was adamant in his desire to get this stage and Brainerd Holmes agreed that Silverstein should have it. How much this decision was influenced by the fact that at that time NASA was trying to ^{please} ~~place~~ Silverstein who had recently left Headquarters to go back to Lewis and how much it was influenced by the fact that George Low himself was an intimate worker and friend of Abe Silverstein's during the total Mercury Program and was Silverstein's man for the Manned Space Flight, I'll never be sure; nevertheless, the arguments for the Manned Spacecraft Center were to no avail. In order to deal with the impact of this decision, the people at the Manned Spacecraft Center worked very diligently on two concepts, one was to establish that the lunar orbital rendezvous was a superior mode which, of course would eliminate the necessity for this hydrogen-oxygen stage and thereby put Abe out of business. The other was a concept which would make this decision a liveable one and essentially a concept which would reduce the interface ^{between} the spacecraft and this liquid oxygen-hydrogen stage (~~termed the lunar crasher~~). The large liquid oxygen-hydrogen engine would operate down to the point where the velocity had been reduced to perhaps two to three hundred feet a second above the lunar surface at which time the spacecraft would stage off from this thing and a small hypergolically propelled stage would actually do the landing. ^{It was given the name} ~~Hence the term~~ "lunar

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 crasher because the large oxygen-hydrogen stage would crash into the lunar surface a half a mile away or so from the place the actual landing was to be made. We were able to pretty much convince Headquarters that the lunar crasher concept was superior to landing this whole combination and were implementing the systems engineering that would go with that. ^{however} We also, were able to convince Headquarters that the earth orbital rendezvous concept was inferior to LOR, and thereby we eliminated the need for this large hydrogen oxygen stage. ⁹ [I also felt from the very start of the Apollo Program that the Headquarters itself was in competition for many aspects of the Manned Spacecraft Center's role. In the case of Mercury, the Space Task Group not only controlled the R&D Program for the Mercury Capsule, but directed those people who were supplying the launch vehicles. The launch vehicle was modified to meet the needs of the spacecraft as defined by the people who were developing the spacecraft. In the case of the Apollo Program, ^{the} ~~this~~ definition of ~~what~~ ^{requirement,} the launch vehicle ~~would do~~, has been taken over by the people ^{at} ~~running~~ NASA Headquarters, who, in my opinion never had the experience that the people in the Manned Spacecraft Center have had in the execution of ^a ~~the~~ Manned Spaceflight Program.

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 For many years, Dr. Von Braun has been personally interested in manned space flight. As far back as the pre-Sputnik days he was considering launching men into space and when I was up in Washington helping NASA establish its programs, I became aware of Project Adam which essentially was a man as a payload on a Redstone Rocket for a five minute experience of weightlessness. When Marshall became part of NASA, its interest in manned spaceflight continued. MSFC legitimized this interest by saying

that it could only study next generation launch vehicles by an intimate understanding of their use and consequently conducted far more advanced studies on manned spaceflight than ^{did} the Manned Spacecraft Center. MSFC has studied ^{both} large space stations and interplanetary flight. In the last two years, as the realization came upon NASA that the heavy development work on the Saturn generation of launch vehicles was coming to a close, Marshall made ^a ~~the~~ ^{other} conscious decision to diversify into the payload area, and in particular trying to get a piece of the spacecraft itself. This had now reached the state where Marshall is developing an orbital workshop and the ^{ATM} ~~atom~~ experiment carrier. The establishment of Marshall into the role of developer of manned spacecraft was one that the Manned Spacecraft Center, of course, objected to right along. However, in a series of decisions by Dr. Mueller, more and more license has been given to Marshall to do just that. The wisdom of this, of course, will not be determined until sometime in the future. It appears necessary in order ^{you} that Marshall ~~do~~ an adequate job in manned spaceflight, ~~that~~ it will be necessary to duplicate many facilities at the Manned Spacecraft Center. They will get these facilities operational only after the Manned Spacecraft Center itself has realized a decline in workload pressure here and consequently the Manned Spacecraft Center facilities would be available. The decision to put Marshall in the spacecraft business has been made over the counter-argument that it would be wiser to transfer people from Marshall to the Manned Spacecraft Center so as to have only one facility in this type of work. I've always felt that the political problem of moving people from one location to another has been the main reason why NASA has not made such a decision. There have been so many separate little decisions that

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have gradually led to the present situation that it is very difficult to recall any particular one, but I can remember when Dr. Mueller came down here at the very start of the AAP Program. It was decided that the Manned Spacecraft Center would have all of the command modules and variations of them. Marshall would work on the payloads that would go into the modified LEM. That gradually evolved into the situation where Marshall would not only work on the experiment payloads but also ended up in control of the LEM itself, as modified. In a realistic sense, it has been very difficult for the Manned Spacecraft Center to argue against such decisions in view of the fact that Mueller has wanted to institute the AAP Program early and at a time when the Manned Spacecraft Center was still overworked on the Apollo Program.]