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[full name of interviewee]

about Science at MSC; lack of attention and respect.
[main focus of interview]

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1968 Dir of Science & Applications

Interview conducted by Robert B. Merrifield, Staff Historian **at** MSC.
[interviewer's name/position] [location of interview]

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Topics - astronaut radiation safety; Gamma-ray lossing; micrometeoroid protection; Science experiments Program; Science & Applications Directorate; Lunar & Earth Sciences Division; Lunar Receiving Lab, (LRL) ALSEP; lunar exploration plans; Earth Resources Program; manned V.S. unmanned Space Experiments. MSC tolerates (not encourages) Science Directorate; STAD interfaces w/ other directorates; Space photographs underutilized; description of LRL; vacuum operation, gas analysis, physical chemical analysis, Bio-Test; Lunar Science Institute (in old West mansion); scientist-astronauts.

INTERVIEW WITH WILMONT C. HESS
November 7, 1968

My first contact with the Center came about four years ago when an ad hoc committee was created to study the problem of astronaut radiation safety. A group of people were called together to determine what kinds of detection systems and preventative measures would be required to guard against the solar flare problems. When this group met it was immediately obvious that MSC participation in the group was essentially of an engineering nature with a little bit of biomed thrown in, but that there wasn't any real scientific capability to handle the problem at hand. The group pulled together a statement of the scientific facts and requirements and presented its conclusions to MSC in regard to the Center's lack of a proper scientific capability. Now the effort of this committee resulted in what is called the SPAN network, and the real time monitoring system for the artificial radiation belt is called SAAP. One other thing came out of this group, namely the suggestion that MSC do what is called gamma-ray logging of spacecraft to find out how thick the spacecraft is when it comes to effective shielding against radiation in space. Now those three jobs were taken over by groups which eventually became part of the Science Directorate.

Another kind of activity that was going on before the Science Directorate was formed and which later became a part of the Directorate involved definition of the micrometeoroid environment and is doing those things which were appropriate to protect against micrometeoroids--determining how to design space suit to be worn on the lunar surface, how thick the walls of the spacecraft ought to be, etc. These were service jobs that

were done as part of the Apollo mission.

The science experiments program and the success in carrying it out have been quite poor. The set of experiments which was done in Gemini was not regarded by the scientific community as very useful and the results were considered only of marginal interest and not especially worth the effort. Now it was clearly understood that the Gemini program was designed to accomplish experiments and it didn't. Those things which were published in the Gemini reports and were called experiments were for the most part pretty poor. So for Apollo a decision was made to set aside 300 pounds of payload to be called "science" and to try to develop a program to use that for proper purposes in connection with the lunar landing missions. That work has been one of the major functions of the Directorate in the past year and yet I would classify its status as no better than a holding action. The program was defined about two years ago and we are desperately trying to hold on to the pieces of the program, as it is being thrown out on a piece-meal basis.

The Directorate was put together about one and one half years ago. Elements which did SPAN and later SAAP and the gamma-ray logging were combined and became an element of the Directorate. The people who did the micrometeoroid protection came in as another element of the Directorate. A small group of geologists who had worked on astronaut training and a lunar surface simulation project came in as another piece of the Directorate. When these pieces were collected there were about 180 people and the organization they were assigned to was called the Science and Applications Directorate. Unfortunately there were not more than one half dozen of them that could really be called scientists. The Directorate

during the last year and a half has grown from 180 to about 235. When I first came here I was told that by this time the Directorate would number about 350 people. What this means is that I've been able to add only about 50 people whereas the earlier assurances were that I would be able to add about 170. That problem is clearly common to all of NASA now. It wasn't simply a Center Management decision not to let the Science Directorate grow, but just the inability to do it, given the resources limitations. Nevertheless the result shows in the nature of the work of the Directorate. The Directorate cannot be called a real scientific organization--as it's a very marginal scientific entity. We have two capabilities in the Directorate which are fairly good. There is a small, young vigorous cosmic ray group that has got a good experiment program going, has good affiliation with outside scientists and a clear potential for producing good scientific results and developing a logical system to go on the Intermediate Work Shop (the EOSL). It is an active, growing group and involves outside scientists. When the Directorate was formed only junior people were working with that group. The other area where there has been reasonable amount of growth and productivity has been in lunar science. There effort has been specifically oriented toward getting the Lunar Receiving Laboratory operational. We have added a reasonable amount of staff in that area and the ability to add that staff was closely related to the fact that the Lunar Receiving Lab was going to be an exciting place to work from a geological-geochemical point of view, especially when the lunar samples begin to arrive. People wanted to be a part of that act, as it is very exciting to earth sciences-oriented people.

The Lunar and Earth Science Division under P. R. Bell is completely

swamped in the operational job of turning on the Lunar Receiving Lab. They are doing essentially no research, and in truth I cannot call it a productive scientific division. On the other hand they are performing one of the most important missions in the Directorate in getting the Lunar Lab operational so in that sense they are doing the job they should, and doing it well. In that division in the last year we added about 20 PhD's in Geosciences to an original group of a few professionals. That group is now reasonably strong although relatively narrow, as it doesn't have the mix of skills that is required to be a strong scientific organization. If the LRL were operational they would be able to do a reasonable research program. Now they are not because of the need to get the LRL in business.

When the Directorate was put together, and when I was offered the job, I was told that the Directorate would combine two kinds of work. It would combine scientific research programs mainly centered in the Space Physics Division and the Lunar Earth Science Division. Second, it would involve the management and conduct of scientific projects. The best example of that is the ALSEP, managed by Jack Small's project office. ALSEP is a set of instruments to go on the lunar surface and in many ways is comparable to a small satellite. It actually has some problems of a thermal nature and a life-time nature that makes it a more complex program than a normal satellite system. It has been managed out of the Science and Applications Directorate and has managed reasonably well although it has suffered seriously from not having a senior geoscientist to guide it in its formative stage. That led to certain probably bad decisions about how to proceed or when to have stopped proceeding on the development of certain systems or instruments. Anyway the ALSEP is a working system which clearly will be capable

of doing well the job set out for it to do.

A serious problem in the Directorate right now is that if we were directed to go forward with the lunar program, we do not have the resources to staff for the major new jobs which would be created/produced by this program. The manpower resources of the Directorate are too small to enable us to do the several lunar exploration science projects, such as the CSM science job, the advanced ALSEP, RTG, or Lunar Rover Science. Those jobs are in the charter of the Directorate, but it's unclear how they are to be accomplished.

Last year I devoted my effort to trying to develop a comprehensive plan for lunar exploration in the 1971 to '75 time-frame, after the termination of Apollo. This planning was begun at a conference at Santa Cruz last summer, where we collected 120 scientists together to provide the scientific input. The major contributors to that study have continued as a committee working with me in trying to iterate the scientific and engineering inputs to that program and to try to see what it should develop into. Now in developing this plan we have worked closely with Capt. Sherer's Lunar Exploration Office at Headquarters and the result has been a very satisfactory product. A plan has been formulated called Plan 3-A, which has all the appropriate scientific elements in it in a reasonable mix of manned and automated systems, and we would like to see it implemented. There are some political problems ~~which~~ which may stand in the way, but we hope it will go. The Directorate also has a serious problem in the sense that the lunar scientific program has not yet been sold. There may be a start up on the lunar exploration plan in the FY70 budget and again there may not. If there is, then the elements in the Directorate that are

project oriented will be swamped with work to do; if there is not, then the program office will be out of business.

Another major element in the Directorate is the Earth Resources Program. When it started, it was essentially a service organization flying a airplane with some instruments on it to make measurements on the surface of the earth from altitude, essentially as a service function to several other agencies--the Department of Interior and Department of Agriculture, Navy Oceanographic Office, and Bureau of Fisheries. We have recently established this as a division under Bob Piland and the division is trying to put us into a position of being a collaborator with the other agencies in producing comprehensive work. The intent of the program is oriented toward demonstrating the capability of certain instruments to produce a useful signature, to tell something about the surface of the earth remotely which can be interputed in terms of a particular product--of a forestry, agriculture, fishery, etc. type. We are in R&D phase on this. There are various people who are trying to push us and others into an operational state, and this is a serious mistake. The thing we should be doing for the next couple of years is trying to understand what kinds of products we can produce and not trying to go out and sell them. We are now flying three airplanes as test beds for instruments, and are flying something like 40 missions a year, producing more and more useful data for more scientists. The program is expanding in a rather happy manner. There is a serious problem about the general aspect of the program in the long run, and that is classification. We currently fly some classified instruments and produce some classified information, which is not a good thing in a NASA program, especially where you are trying to demonstrate to a potential customer the

usefulness of a product. We are continuously trying to get instruments to be de-classified or to find unclassified instruments which can do the job. We win a few, but we are not winning very fast. In the general manner of imaging from space, we have serious concern as there is a substantial limitation put on us which in the future will have considerably more than just a nuisance aspect.

In addition to running the three airplanes and trying to produce a useful well-rounded program of instrumentation, data, and analysis, the Earth Resources Division is also trying to develop systems to fly on space vehicles. An attempt is being made to fly some instruments on AAP and the OSL. Last year we went through an abortive attempt to get the AAP-1A flight put together as an earth resources flight. There was a reasonable instrument compliment proposed, and there was a pretty good probability of getting useful data out of it, but it floundered when it was compared with automated systems whose instruments would not be nearly as good but would have them up for a longer period of time. Thus it would be possible to guarantee to the user that he would get some information. The major problem with the 1A flight was that it was only going to be a couple of weeks long and if the earth was shrouded with a complete cloud cover, the flight could come back with no data about the earth's surface. The users decided it would be better to have an automated system with poorer instrumentation but with a guarantee of partial data return. That is a problem that will haunt us in the future--there is serious doubt whether man will ever play a useful role in the R&D phase of the earth resources program, and the outlook is even more pessimistic over his likelihood of playing a useful role in the operational phase. This situation leads logically to another problem, in-

volving the issue of man's usefulness in spece in general. When it comes to science, it's been concluded that it is fairly marginal. In terms of unique roles that a man can play or jobs he can do that can't be done as well at lesser cost by automated systems, the only one which is really obvious is that of a field geologist on the surface of the moon. A field geologist is very difficult to automate and the matter of going forward with a lunar exploration program involving man seems to be essential if we are going to understand the moon. For earth orbital activities and the kinds of tasks man can perform that can't be automated, we find it difficult to come up with anything meaningful. Instrument repair and data retrieval for example, long considered to be an area where man was required, really can be automated and done cheaper.

The existance of the Science Directorate is tolerated by the rest of the Center, but not encouraged. It's clear that the rest of the Center doesn't really think that science is an important element in the present space program, and not enough people have spent enough time thinking about future programs to have developed a conclusion as to whether it's important even for them. There really is little active opposition to it in future programs but at the same time there is not very much effort to encourage it. In present programs when a problem comes up about science versus safety or science versus operational convenience (and I really mean convenience and not operational necessity), the scientific option almost always loses. It probably is appropriate that it lose because during the phase when a new system is being developed nothing should get in the way of the thing being developed. The development should go forward and end up with a useful end product. But then there ought to be an understanding

that the product ought to be used for something meaningful and the Center has not taken a clear position on this. The Center does not consider utilization of developed capabilities a major element in its future plans. The lunar exploration program is an example. It's unclear how much support this plan has inside the Center.

S&AD also has other problems; for example interfaces with other Directorates are frequently awkward. The Astronaut Office rather frequently voids our effort simply by using the argument "it's not a very good system for a man to work with," and in changing the system to make it "workable," it is degraded from a scientific usefulness, standpoint. Operationally, science has a very low position in the pecking order. It has been recently demonstrated that it takes a position well below TV, which may be appropriate but it is disconcerting. Substantial science involvement in the next program--whether EOSL or Lunar Exploration--is dubious. By that I mean it is unclear that the Center will change its attitude sufficiently, or start emphasizing the utilization of existing capabilities enough so that a rational scientific program can be carried out. In Mapping Sciences, the group under Jim Sasser and John Dornbach, played a substantial role in producing products which were necessary for the selection of the Apollo landing site and for astronaut use on the lunar surface. Again this was an operational task in support of Apollo. This group is not playing a reasonably strong role in analyzing return photographic material from space, although not as strong as I would like it to be, principally because the group simply is not large enough. Space photographs are not being properly used by any major group in the country from a research viewpoint because of a lack of properly trained people.

The Lunar Receiving Laboratory is a well constructed and well thought out facility. The conception of what the capabilities of the Lunar Lab should be was developed by a group of outside scientists called the LRL Working Group. This group drew its membership from the USGS and other scientific organizations and in the ideas of how to examine samples, the kinds of equipment that would be needed, the quarantine arrangements to prevent back-contamination--are all well thought through, and although I did not always agree with the results of this Group's deliberations, I firmly believe the deliberations were well conducted and the end product is one which was well thought out. We are now in the phase of implementing the product and the LRL is undergoing operational readiness inspection. It still has a lot of rough edges but it's coming along.

The LRL is divided in about four different areas. There is the vacuum operation area, where we have probably the most complicated vacuum system in the world. It has astronaut gloves going into a vacuum of 10^{-7} torr from 15# pressure. It's the only operational vacuum system in the world where a person can manipulate samples and tools in that degree of vacuum while standing out in a normal surface atmosphere. This system has to be extraordinarily clean in order to prevent contamination of the sample, and that also makes the vacuum system unique.

The gas analysis laboratory is upstairs from this area, and the low level counting lab adjacent to it are special purpose laboratories. They have been developed with the help of outside scientific groups and are both excellent. In the physical chemical analysis area, the techniques and the tools that are used have been developed by the LRL Working Group and are excellent. The bio-test area is one which has been developed over a period

of two or three years in conjunction with the Interagency Committee on Back Contamination. Here we have had some headaches. A very substantial portion of the lab is devoted to biological examination of samples to demonstrate that they don't contain any pathogens. This being a safety-oriented job that takes precedence over what might be called science-oriented work. This has caused certain conflicts. For example, the matter of how the laboratory will operate is still uncertain. We want it to operate as a research lab between missions. During operational periods after missions there will be samples in the lab for one to two months undergoing analysis. We will put them thru the biological protocol and thru the preliminary examination to find out what they are and then they will be distributed to PI's. During that period the lab can't be used as a research facility. But that's only for two months, and if we have missions on six months' centers, then there is a four-month period when the lab ought to be able to be used as a research facility. In order to accomplish this, the lab has to go biologically cold, and by that I mean that the pathogens that are to be used in the laboratory for analyses have to be handled in such a way that they won't interfere with the conduct of a research program. That is a problem area right now. It's not sure that it can be done and we are in jeopardy of losing the LRL in its entirety as a research facility.

That brings to mind another subject, the Lunar Science Institute. I've worked with Wes Hjornevik all this last year to try to bring this institute into being. It is to be housed in the old West mansion and is supposed to attract outside scientists to the Center and thereby add to the aura of science. When I came down here this place had almost no aura of science. In fact, people on the outside considered it as an anti-scientific

establishment, and I don't mean just non-scientific; I mean actively anti-. The matter of giving it an aura of science simply involves inducing a reasonable number of scientists to work in the LSI and with our people here. We are making good progress in doing that. We've got Professor Harold Urey, Professor Geiss from Switzerland, and Professor Thornton Page, the distinguished astronomer. These are people who have been brought to the Center thru my efforts and those of P. R. Bell and Karl Henize, one of the scientist-astronauts. Henize helped to get Thornton Page to participate in our scientific research programs. The Lunar Scientific Institute will be used by these visiting scientists who come to work in the LRL. The LRL is not a research lab in the ordinary sense of the word, but if these scientists can't use it the LSI will lose at least 50% of its usefulness.

Scientist-astronauts is another subject where we have an interesting problem. The scientist-astronauts are very capable as a group and they should be relatively scientifically productive over the next several years if, when they go on a trip, they are still worthy of the description scientist. The problem here is that the first generation of scientist-astronauts have not done any science work of consequence since they were selected. They have gotten completely involved in operational matters--in committee work and in review of systems. Their scientific work has just gone out the window. That is a crime. A few months ago Deke Slayton and I agreed that we would write out some plan to utilize the scientific capabilities of these astronauts, that is the old six and the new 11 (now down to nine), and that these plans would be incorporated into the basic functional responsibilities of the astronauts. They would be expected to

carry out a program of scientific research as well as learning systems, maintaining their flying proficiency, etc, and that this as a factor would be considered important when it came time to select crews. Even though we have formulated these science plans in writing, I am still very skeptical of how and whether they will be carried out. An astronaut can become completely wrapped up in programmatic matters, and I will not be surprised at all, when it comes time to review the progress of this group, to find that they still aren't doing much scientific work. The astronauts represent a reservoir of considerable scientific talent, especially the new nine. They are very good people and we clearly need to use them in a scientific mode. We are trying to involve at least one half of them in the activities in the Science and Applications Directorate. Even though the new nine are still off at flight training, we do have them actively involved in a couple of research areas, but they cannot be actively involved until they are actually here, and it will be March 1969 before they will be back at the Center.