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CONTENTS:

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

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Education - _____

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Career Path - _____

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Topics - With STL working on Mercury & Gemini booster guidance; STL contract for Apollo trajectory calculations & mission planning; 1965 to Houston w/ TRW; TRW staff peak & morale decline (1968); effect of Apollo fire; FOD support contract; ASPO support; problems w/ hiring problem-specific employees; TRW internal rejection - Los Angeles & Houston; M/S ratio of TRW professional personnel to support personnel; difficulty recruiting; TRW diversification in Houston area (automated def'ized equip & traffic control analysis); description of Flash system contract; M/S squabbles over ~~Apollo~~ technical problems affect TRW work; Apollo Spacecraft Systems Analysis Program and inter-contractor relations; prime contractor problems w/ MIT; Contract award fee & incentive fee evaluations

INTERVIEW WITH CLARENCE W. PITTMAN
July 15, 1968

For the Mercury program the Air Force supplied the Atlas booster and STL was working on the booster as a subcontractor. I was involved in those days on Mercury as were a number who are still within TRW. Part way through the Mercury Program the Aerospace Corporation was formed and the STL people who had been working on Mercury were supposed to transfer to the Aerospace Corporation and continue to work on Mercury. I didn't want to transfer and remained with STL. Aerospace signed a subcontract with STL to provide essentially the services I was performing for the Mercury Program and STL continued after Aerospace was formed with a very small effort which involved two or three other people and me working on the Mercury Program on booster guidance problems. Toward the end of the Mercury program NASA requested a contract with STL to prepare trajectory plan, computer applications, etc. for Gemini. STL continued working on that trajectory calculations and trajectory dispersion analysis contract for MSC with people in Los Angeles. After the first Gemini orbital flight it turned out there was a problem in the booster guidance and although a year and a half earlier I had gone to work with TRW outside the space program, I came back to work on the Gemini Program. I helped solve that problem and continued to work on Gemini booster problems while with Aerospace Corporation. In the meantime Apollo had begun to develop and MSC requested a contract with STL to provide trajectory calculations and mission planning support for Gemini and Apollo and included in this contract was a request to move people to Houston to support MSC. In addition to the new contract for mission planning activities in support of FOD, they also

requested a contract for systems engineering-systems analysis support to ASPO. For contractual convenience those two statements of work were combined into one contract, and they have stayed together down to the present. The two activities have been carried on in Houston essentially as independent contracts within both TRW and MSC except for procurement and contractual activity.

Under this contract we drew a curve of manpower versus time which showed the number of people we expected to acquire. The number of people has changed on both parts of the contract--it has increased upward two or three times and we now have about 50% more people than we originally started out to provide. Part of the reason for the increase was picking up work on AAP while the Apollo Program was still in progress; part of it was the evolution of problems which we hadn't previously anticipated on Apollo which required different kinds of activities than originally expected. I came back to TRW and came to Houston about a year after the present contract was begun around the end of 1965. We had about one-third as many people as we have now; we've multiplied by about three. We maintained an active recruiting program in Houston all during this time, but in the last few months we have begun to see the end of the really intensive recruiting on both parts of the contract. We now see what we think is about the ultimate level of people we will need and don't expect to grow very much from where we are now. This is causing us minor problems. The atmosphere within TRW in Houston for the past two or three years, while we were growing very rapidly, was dynamic and a lot of people were getting promoted. We were taking on new types of work as we got the people onboard. I think people within TRW now see the end of the era of

great opportunities for personal advancement within the company and there has been a definite decline in morale in 1968. Two other things that affected this decline in morale: the fire and the fact there was such a long period of time where there was not very much to do for the people who weren't directly involved in solving the problems that the fire indicated. The national publicity about the space program this year, the presidential campaign, and the budget discussions, have taken the edge off the enthusiasm of a lot of people and has caused them to stop and wonder if what they are doing is really productive.

Under the FOD support contract the type of work we do is in the area of computer applications and mathematical analysis, trajectory calculations and the development of real time computer programs. Our work is heavily computer oriented and obviously heavily oriented toward mission planning and flight operations. There has been a general trend over the period of the contract away from preliminary planning and toward more direct flight support and also toward more involvement with the performance of the real hardware and the ability to evaluate it inflight. As time went along we have picked up some other types of specialists on this contract--engine specialists, environmental control specialists, etc.

The other part of the contract which was to support ASPO has involved systems engineering and requires the services of a wide range of specialists. We have had one large group of people who have worked in direct support of ASPO writing things like mission plans, mission requirements, and detailed test objectives. They in turn drew support from within TRW from specialists in propulsion, structures, aerodynamics, thermodynamics, guidance and control, etc. About a year ago that support effort was di-

vided into two parts within MSC and within TRW. This arrangement is informal since we've not designated anybody to be in charge. One element supports the E&D Directorate. A fellow within E&D is supposed to have overall cognizance, and we have a guy who is supposed to have overall cognizance for TRW. The other part continued to be direct support of ASPO. We have a fellow who is in charge of that effort, but we haven't been able to identify the fellow in charge in ASPO. Although one person nominally has this responsibility he has never had the clear authority he should have. MSC has had a good bit of trouble with changing requirements and uncertain visibility of future requirements on that part of the contract than we have had on our part. On the part of the contract with FOD our contact has always and primarily been with John Mayer. He has felt a considerable personal responsibility toward us in terms of helping us plan and maintain some stability in our people.

We also have had a problem in that portion of the contract involving E&D and ASPO. We've had the situation where people within MSC would ask for special support, for a particular problem, and we would recruit a crew of people to solve that problem, and when it was solved we would find that we no longer had a need for that category of employee. Several times we have hired perhaps up to a dozen people in Houston and then suddenly find we didn't need them any longer. An example was a specification review task where we were trying to look over the equipment specs for the Apollo spacecraft to see if they were consistent with each other and that they were consistent with the program objectives. I don't know what happened within MSC, but somehow there was a conclusion reached that we should not be doing that kind of work and there was a directive from MSC

to that effect, but in the meanwhile we had a crew in Houston whom we had recruited to do this job. It was a low technical level job and it didn't require a great deal of technical sophistication, whereas a lot of the other work we are doing in Houston does, and these people were difficult to shift into other organizations because they didn't have the proper background. The net result there was that a number were laid off and a few were transferred back to Los Angeles. Another problem area has been in structural analysis where we either do or don't need a bunch of structural analysts. We haven't ever been able to get it clear whether we do or don't--sometimes we do and sometimes we don't. We happen to have a problem there right at the moment and also we are having a problem with people who are concerned with heat flow within the spacecraft. These again are structural analysts and thermal analysts, and since they are somewhat specialized it's difficult for us to move them around.

When TRW was asked to co-locate in Houston with MSC the company did not provide support for the people in Houston other than the contract with MSC, which meant that we didn't have very much flexibility if the work changed, and we no longer needed a particular type of person. We still don't have very much flexibility in what to do with people. Related to that problem was the acrimony that developed within TRW between the people in Houston and people in Los Angeles. When we started in Houston, we were using a considerable number of people in Los Angeles to do analysis work for us. We planned to eventually transfer people to Houston or recruit new people locally to do that kind of work and to terminate the work in Los Angeles as we did. As we were successful in recruiting here we took work away from the people in Los Angeles. They thought that was

unfair, there was a great deal of acrimony, and we had a great deal of difficulty ending jobs satisfactorily in Los Angeles. When we got to the point where we had a crew of people in Houston who could pick up one of the jobs, we would tell the people in Los Angeles that their work was going to end in a few months and that we wanted to transfer the work to Houston. They then had a tendency to take the good people off the job and to loose interest in it since it didn't have any future for them. This meant that lots of the work we started in Los Angeles terminated under very bad conditions because we couldn't seem to get the job done out there, and as time went along we got more irritated about the work not being done properly and they got more irritated about our taking the work away from them. It was a most unenviable situation. I think we've learned something within TRW as a result, and next time will be able to accept the fact that that's inevitable and we will have to be willing to recognize and accommodate it.

We have a very high ratio of professional personnel to support people here in Houston--4:1. We essentially don't do any clerical type of work on this contract. All the people performing directly on the contract are professional and the only non-professional people we have, are those required for routine support, such as secretaries, reproduction services, etc. We don't have any draftsmen.

Recruiting has been difficult for us, although we've been very successful. The difficulty in recruiting has come primarily because Houston doesn't have a very good image nationwide and many people were not interested in moving to Houston or Texas. We found it necessary to recruit from a different group of schools than we customarily recruited from for

work in Los Angeles. The schools we recruit from primarily to work in Houston are those located in southeastern and southern U.S. We don't have much success in recruiting from schools on the west coast, the middle west or northeast.

In terms of morale and esprit d'corps we haven't had a problem until about the last six months. We were growing rapidly up to that time, the work was evolving and personal opportunity was developing along with it. In the last six months as our rate of growth has declined and with the generally poor national publicity regarding the space program, the morale of our employees has dropped and our employee relations problems have gotten more severe. In the future we are going to have to be very careful or we will develop a casual, routine attitude toward the work. We are trying to diversify our base in Houston, and use the people we have here to develop other kinds of work particularly in non-aerospace fields. I hope that type of activity will provide the challenge that will prevent the people from getting into a routine mode. It helped in this respect when the company acquired a small oilfield production equipment company, the Mission Manufacturing Company. We are working with them on automated oilfield equipment production control and perhaps that will develop into a fairly major activity over the years. We are also beginning to consider a lot of the non-aerospace applications of the skills we have to other types of projects in the Houston area. We also have a contract with the Bureau of Public Roads for downtown traffic control analysis, which really is unrelated to our presence in Houston; it just happens we had some people interested in that type activity.

On both parts of the contract we have a task system. We define the

details of the work to be done in terms of tasks which vary from six and one half man-months to maybe 100 man-months and involve from two to three people up to perhaps 15-20. On each of the tasks, we assign a single man to be responsible and NASA assignes one of their people to be responsible for their function. A more or less definitive work statement is drawn up. We have direct personal interface with people at NASA in management from Division level down to the working engineers. We've had very good relationships with our NASA counterparts. There are a great many people involved, and some problems would be normal--personality problems, conflicts in judgement, etc.--but they have never been really serious for us. We have always been able to resolve them by bringing them to a high enough level of management attention. For example, there was a disagreement over a technique to be used in solving a problem once the problem had been defined. Our task manager and the NASA monitor, if they had a conflict they could not settle over how to solve a problem, they arrange a meeting between their bosses--normally a branch chief at NASA and an assistant project manager within TRW. They would review the problem and the alternate approaches and try to agree on a reasonable approach. We've always managed to conduct those discussions in terms of what's the best technical approach to the problem, and seldom does personality or parochialism enter in--the "I want to do it my way because my people like it that way" attitude. Nearly always it is discussed in terms of the most effective technique to use. If those two guys can't resolve the problem they arrange a meeting with John Mayer and me. Before we got into the act there would probably be a couple of preliminary meetings where some people from my staff and some people on John Mayer's staff would try to

resolve the difficulty and if they were unsuccessful, then there would be a meeting between John Mayer and me. I only know of one case when Mayer and I haven't been able to agree on the terms of the work. It was a problem on how to direct the guidance software development on the spacecraft and I talked to Chris Kraft two or three times about it, once with Bob Muchmore who is Vice President of TRW and my boss. I guess I wound up agreeing with and understanding Chris' attitude toward the problem, and what constraints he felt like he was operating under. I don't know what I would have done if I still felt that wasn't reasonable. I guess I would have felt confident enough in my relationship with Chris and John Mayer to have carried the controversy on further. As it turned out we've worked on the approach to the problem that Chris wanted and I think it's worked out satisfactorily.

There are more disputes in the other part of the contract than on the FOD portion, but I don't know the details enough to talk about them. In one instance, a very embarrassing situation developed over the need or lack of need for more fuel tanks on the LM. One of the MSC people told TRW to work up the argument against the additional fuel tanks. I think he was trying to approach the problem from an alternate system; everybody else was saying the fuel tanks were needed and he wanted somebody to determine if in fact, they were not needed. A lot of people within NASA got the idea that TRW was recommending not to put the fuel tanks on and I don't think we tried to reach a conclusion as to whether we needed the fuel tanks or not. There was considerable controversy about that and a good bit of acrimony.

One small problem we have had off and on with MSC has involved squab-

bles over technical problems within MSC. Frequently we weren't aware there was a fuss, and wound up appearing to be taking sides when we really weren't. We also have had minor problems with other support contractors, usually in terms of the working crews rather than management problems. At times when we have shared jobs with other support contractors, there was a tendency for the crews of the two companies to compete for control of the job. In one case this led to messing up the work, because our crew and the one from Lockheed were in a hassle over the development of the computer program and both sides were being obstinate. Unfortunately in that case, Lockheed's direction within MSC was coming from CAD, and our direction from MSC was coming from MPAD, and those two groups were also struggling for supremacy, which didn't help solve the problems. We've had other job contact with Lockheed since then and there have been a few conflicts but no more than there have been with other groups who had to work together but didn't have a common boss within TRW. Fortunately we haven't had any serious problems. We've had finger pointing from time to time either from TRW or from IBM or someone else trying to explain why the job wasn't done or not done properly, and people working on the job would try to shift the blame to the other group. But this type of problem has been no more severe than one would expect any time two groups of people work on a job.

On the ASSAP, Apollo Spacecraft Systems Analysis Program, our people have had contact with Boeing and GE, and feel the competition from the other support contractors more keenly than we do on the Mission Trajectory Control Program (MTCP), because the work is duplicated a lot more. On the MTCP there is a fairly clean separation of the type of work we do versus

the type of work IBM does, etc.

In relationships with NR and GAEC and MIT, originally we did not have much contact with them. Many people at MSC wanted to keep us separate and they would talk to NR and they would talk to us but we weren't to talk together. That has largely gone away in the past year. On the jobs we do which require contacts with the other prime contractors, I think the contact is satisfactory. The one prime contractor who has been a problem, has been MIT. We've had problems with MIT but so has MSC. A spacecraft software review committee headed by George Mueller has been in existence since the first of the year looking over the software development problems. I've been a member of that committee along with people from MSC and LRC, MSFC, IBM, Aerospace Corporation. MIT's problems, in part, have been caused by unclear direction from the Guidance and Control Division of MSC on software development.

On this contract we have a combination of award fee and incentive fee for a three year period. The incentive fee is a cost incentive arrangement where there is a thing called a recomputed target cost, which is essentially a negotiated cost, recomputed in terms of the actual work we do, as compared to the actual cost. The fee is based on that. We didn't do a very good job of estimating what the costs were going to be three years ago as we didn't have very much experience working in this kind of environment and a good bit of the cost negotiation was based on experience in Los Angeles. Our costs turned out to be a good bit less than we had negotiated. The primary reasons for this were that we had a government furnished computer in Houston and our computer costs have been very small per manhour. We expected more travel to and from Los Angeles than we ex-

perienced, and since we recruited a lot of new people for the company here in Houston, we generally got people with fewer years of experience than in Los Angeles, and as a result, our salaries have been lower here in Houston than we had anticipated. We have easily earned the maximum cost incentive for the three years. We are now on a one year contract extension and in this negotiation I think we came very close to negotiating what the actual costs are going to be.

The other part of the fee for TRW is an award fee which is based on evaluation of our performance. There are three parts to that: one is made up of a weighted sum of the evaluations of all of our individual tasks which we get monthly from the MSC task monitor with a grade associated with it. These are weighted over the quarter and make up part of the basis for the fee which is awarded by a Center-wide committte quarterly. That's a subjective evaluation by the MSC task monitors. The whole award fee is really subjective although we have some guidelines. It's based on the subjective judgement of how well we perform. The second part of the award fee is based on technical management--how well we do the job. The third part evaluates our business management and involves such things as the promptness and accuracy of our business reports. We found it possible to discuss frankly the grades and the meaning of the comments that accompanied them with the people at MSC and really don't have any objection to the fact that they are so subjective. It obviously conceivably could be a problem particularly if we could get a guy at MSC who subjectively felt like the company shouldn't earn such a fee. I don't think the award fee system itself has been particularly beneficial except for the fact we get visibility in great detail on our performance and that's helpful. If

we just got an award fee which didn't have very frequent feedback or very detailed feedback, I don't think it would really be very effective. If applied properly an award fee ought to be used as a carrot. In order for it to be used in a positive sense, it is necessary for us to have feedback on the opinion within MSC on how we are performing, on a frequent enough basis, and in enough detail to allow us to something about it if it is not right. If all we were getting was a quarterly statement from MSC telling what the fee had been for the previous quarter, I doubt that would be frequent enough to be helpful in redirecting the work. In terms of managing, the work within TRW the award fee and the monthly evaluation really is very helpful in giving us an outside view of how our crews of people are performing soon enough and accurately enough to allow us to shift people or redirect them if necessary. We've been very happy with it. One bad feature it's had has been the thing we've fought against all the time--the tendency on the part of our people to want to maximize the fee that they earn in their task and this might not be the same thing as performing the best service for the Apollo Program. The easiest way to get the best fee for a long time on a task is to hold hands with the task monitor and do whatever he says do. If he is a good man that's fine, but if he happens not to understand the problem adequately it will cause the contractor to go down some primrose path and not get the job done like it should have been done. Whether or not that's a problem has to do with the maturity of the person assigned within NASA as task monitor. If he is a good mature man we don't have the problem--if he's a youngster sometimes we do have the problem. Our grades are similar to the grades in school are. People think grades over 90 are good because that's an A, and

80-90 is a B, etc. and there is a tendency for people to want to maximize the grade and talk a great deal in terms of the grade rather than in terms of the actual performance. That's what we try to combat. We like a good grade but we think it's more important to do a good job. A lot of the stuff we do is developmental and it's the sort of think that's difficult to predict as far as schedules are concerned because it's hard to anticipate what problems will be encountered. A problem can change in midstream or ever disappear. To try to set up a hard firm criteria in terms of deliverable items and schedules, will work for hardware items or specific computer programs, but not analyses.

One of the frustrating problems about grades we've encountered is what to do when MSC changes its task monitors. There is a tendency for the new man to want to show he knows a helluva lot more than his predecessor about the job, and he is inclined to be pretty critical of the task and its present status for a few months. During this period the grades will drop. After a few months they will come back up again as the contract gets directed along the lines he likes rather than what his predecessor liked. We just anticipate that problem and suffer with it, and have told our people to expect it.