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CONTENTS:

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

Education -

Career Path - Langley Research Center; 1959 - STG, Reentry development program; 1962 Langley Research Center

Topics - Initial association with Space Task Group; re-entry capsule design and testing; high-altitude balloons; altitude chamber testing; hiring of Avro Co (Canada) personnel; STG + ground Mercury network group interface; astronaut and flight controller training; John Glenn's training interface role; Redstone Laurel observation at Cape Canaveral; coordination by Flight Operations Div.; 3-man flight control team; training for MSC Mission Control Center; training capsule; Gemini Program as link to Apollo; decision for 3-man Apollo capsule; upgrading of initial Apollo RCS to include earlier landing; criticism of ~~both~~ failure to integrate Mercury + Gemini operations experience into Apollo design + management system;

1318

Interview with Gerald Brewer
7/18/68

I first became acquainted with the STG activity while in charge of the fullscale wind tunnel activities in low speed aerodynamic research at the LRC. LRC was undergoing a basic reorganization. I wanted a greater challenge and due to the retrenchment in low speed aerodynamics at the time, I contacted Bob Gilruth about September 1, 1958, and asked for a job. He had just pulled together the nucleus of the STG in response to a directive from Headquarters formulating a space agency. I reported for duty on January 1, 1959, over in a makeshift arrangement in the unitary plan wind tunnel building on the second floor. I was assigned to Chuck Mathews and in the next couple of days was given an orientation by Merritt Preston. I had known him previously when we both worked under Abe Silverstein. Merritt had come from Lewis along with Scotty Simpkinson and a few others, who ultimately assumed charge of the Mercury activities at the Cape.

I was assigned to the support of the reentry development program. To qualify the capsule and its reentry system, we were planning a drop test from a high altitude balloon. I worked on this project for 2-3 months scouring the country for a high altitude balloon and talent capable of conducting such an operation. I ultimately made arrangements through the Air Force Cambridge Research Center which had had considerable experience with the Minneapolis-based Whitsome (?) Co. which had built several high altitude balloons on an experimental basis. These balloons had reached close to 100,000' at the time. Andy Meyer and Caldwell Johnson were to provide a boilerplate spacecraft such that we could adapt

to this balloon program and run drop tests to study the parachute deployment, G acceleration and other aerodynamic parameters. This work got to the point of contract definition, but funding difficulties and other organizational problems eventually killed it. It was to involve a roving ground retrieval system and possibly a sea recovery and this could have been a far more expensive development program than STG had anticipated, so I was asked to investigate cheaper ways. We went to the Lewis Lab and determined we could fire the retrorockets and run some of the aerodynamic tests in the Lewis altitude chambers, and this is what we did.

In the meantime Gilruth, Faget, and others went to Canada some time in March or April 1959, and hired about 50 Avro Co personnel. The procurement of the Avro Arrow Airplane had fallen through and they were left without work. These were men handpicked by Jim Chamberlin, who was the chief engineer in the company. Chamberlin and his handpicked people came South and joined up with STG; many became American citizens and some are still here. Several of these people were assigned to the Operations Division. Within a few months we were involved in an organizational change: I was assigned as Flight Control Branch head responsive to Chuck Mathews. There were several other branches; there was the trajectory management branch under John Mayer, Recovery Branch under Bob Thompson, and a planning group under John Hodge.

My branch had several responsibilities; one group under Harold Johnson, one of my section heads, was responsible for training the astronauts and all the flight controllers. Another group under Howard Kyle as a section head and with Dennis Fielder as one of his key men, was responsible for ground systems support for flight control. Ultimately they were key

men in contract activities administered by Barry Graves and his people at LRC who were responsible for the Mercury network. Howard Kyle and Dennis Fielder were the interface between the STG and this ground Mercury network group, in bringing in all our requirements of flight controllers and mission controllers into the major network system. We were also responsible for the Mercury Control Center development at Cape Canaveral. This was administered by LRC under a contract to the Western Electric Contract but a portion we managed pretty much technically with the Bell Tel group out of Whippacey, New Jersey. This was an excellent group put together by Bell who worked on the display concepts, the data management, the communications, etc. It was a remarkable program done very rapidly in a 1½ year period. I had another section responsible for mission rules, flight procedures, training manuals, and flight operations plans under Fred Matthews, a Canadian, who is now a naturalized U.S. citizen. His people produced all the important documentation supporting these related activities. They set up the methods of training for astronauts and flight controllers normal and abnormal missions in simulators at the control centers and at the eleven network sites located around the world. The Mercury network was a $50 plus million program which included tracking stations, telemetry receiving stations, several ships for tracking, telemetry and communications. This was coordinated into a partial network that already existed at Goddard. We had air to ground communications for the astronauts and my branch was responsible for implementing the mechanics of training the original 7 astronauts. We worked very closely with them on technical and operational training and John Glenn was one of our key astronaut associates because he had a sub-task to manage the training interface between the

astronauts, and the engineers, and operating personnel. He had a great deal to do with the success of that activity. Harold Johnson and Stan Faber made significant contributions to the training devices used. They ranged from air bearing devices to highly sensitive partially zero g simulating devices. They included various unique display systems for orienting astronauts to the star patterns and ground observations and some of the simpler hand computers, etc. Fred Matthews and I made a first trip to Canaveral in May 1959. We were invited into the blockhouse to watch the launch of a Redstone vehicle. The purpose of our visit was to prepare flight control procedures to govern operations in the ABMA blockhouses servicing Redstone. Mercury was to use 2 or more Redstone flights as part of a buildup to its flight program. As a result of our technical liaison with this expert group, we were able to determine console arrangements and data handling capabilities that would satisfy our interface.

My people worked extensively with many groups at the Cape: RCA, Pan Am, Air Force military agencies and others in getting this lashup of military networks for launch support and the worldwide military networks integrated into our Mercury network. We had to coordinate the procedures, the requirements documents, satisfy Cape safety standards for the launch and the abort system, etc. It was a very busy and difficult period because we were going through a learning process of how to operate under rules and regulations and documentation systems that had been developed to support other Cape launches. Within our Flight Operations Division, Robert Harrington, who used to work for me in the aerodynamic days in the wind tunnel, was the technical liaison for Chris Kraft at the Cape

on the booster program, the procurement of the Atlas system, and all other related matters.

A significant flight operations complex was developed in Hangar S at the Cape and by the time it peaked out we had nearly 200 NASA and perhaps nearly as many McDonnell people there at one time, working 3 shifts. The whole operations function was coordinated and managed by Walter Williams who had come to STG from the Edwards Flight Research Station. Walt was the kingpin of Management activity and glued together the loose ends of flight operations particularly in relation to the necessary coordination with General Yates, his successor, General Davis, who were in charge of all DOD activities at the Cape.

The Mercury network was put together in about an 18-month period and became available to us early in 1961. We had a good many partially trained people by that time. At first we assumed that STG would assume the total responsibility for manning and performing the Flight Operations. We tried to do this using STG personnel but at the end of a year, it was evident that this was not realistic, as the average engineer is not necessarily compatible with the flight operations requirements either technically or operationally. It is a very demanding job requiring a great deal of travel, a great deal of dedication, many strange working hours, etc. For each station in the network we planned to use three flight controllers -- a system man, a flight communicator who would talk to the astronaut, and a physician who would represent the flight surgeon and watch over the medical safety of the astronaut. These teams plus a backup group of almost 40 people had to be vigorously trained in all aspects of the operation of the capsule, the flight plan, the onboard experiments,

and the health of the astronaut. Ultimately we solved the problem of shortage of personnel by going out for bid and Philco was awarded a contract to furnish men with 15 years or more experience in communications, systems operation, and general large systems management. These men were ~~pulled in by~~ Philco's Field Service organization from all over the world over a weekend and were assigned to my branch as flight controllers on a year-to-year contract. They worked out exceptionally well. We only changed one or two of these personnel during the first 2 years of the contract. Many of them came to Houston and some later transferred to MSC.

The Mission Control Center at the Cape was manned mostly by our own personnel, Chris Kraft, John Hodge, Bob Thompson, and 2-3 men in my organization who were key console operators and analysts. These men were ~~trained under~~ a special training program devised for them exclusively at the Control Center.

We developed a capsule procedures trainer, a real lifelike Mercury capsule used as a trainer, and adapted to displays and mock flight controller consoles that were similar to those used at the sites. Through this mechanism, we debugged the system and learned how to train our people. Later a similar unit was provided at the Cape and operated largely by the contractor personnel. A fellow named McCafferty was the McDonnell man in charge of that trainer and is now a NASA employee responsible for similar work on Apollo. With this trainer we were able to simulate in very real life fashion the signals and response of the astronauts. We put the astronaut

in the trainer and he would simulate normal and off-nominal functions and converse with the men through a communications link just as though he were flying. It was a very realistic and very effective training program. It paid off because every Mercury flight was a cliff hangar, although in retrospect it wasn't nearly so serious as it seemed at the time. On John Glenn's flight when there was an indication that the heatshield had separated before reentry, there was real concern as to whether he would be able to reenter satisfactorily. The Flight Control team responded ~~beautifully~~ professionally and did not get flustered. They analyzed the matter, conversed with Glenn, looked over all the drawings of the circuits and decided that the logical explanation was that a limit switch sensor had failed. A few tests were performed, and the spacecraft wiggled around a bit and nothing changed so we decided everything was normal. There were many other experiences where the training brought us over the hump, and made it possible to have a relatively cool operation. The Mercury flights were basically similar but each had a unique flight plan with different flight procedures and different experiments. There were different astronauts in each case responsible for the flight but the ~~and~~ basic planning ~~our existence~~ was patterned in both a technical and operational sense. The only problem was to get everything done on time and properly qualified.

The Gemini Program was an extremely valuable link between Mercury and Apollo. I thoroughly agreed with Chamberlin's early concepts. Chamberlin had the long range viewpoint that Mercury would be over very shortly, and there would be no manned flight activity for the nation for a period of

about 4-5 years until Apollo could get cranked up. He knew what would happen. There would be a loss of national interest and pressures would develop to do something about it. The Gemini program was stimulated partly by the fact that it seemed reasonable to take an upgraded Mercury capsule, use the same basic design concept but make it larger, with a greater weight, use a different booster and even go to the moon. Not too many people actually realized that in the original Gemini concept, Chamberlin had conceived the ability to get to the moon with 2 men. As a result of this attitude there was an internal power struggle over the feasibility of utilizing practical and personal experience to develop this capability. At least this is the way I saw it, although I have no authoritative information to back this contention. I do believe there must have been quite an internal struggle at Gilruth's level as to what to do, because the new Apollo ~~people~~ project group had an open charter however to plan a manned lunar mission. They had looked at all the tradeoffs and had come to the conclusion they needed a 3-man capsule to provide a logical redundancy in flight safety for such an adventurous program . They felt they had to have a fairly sophisticated, large spacecraft requiring a huge booster system. Any suggestion like Chamberlin's to use a 2-man capsule to go to the moon would just cut them out. I believe the compromise must have been that yes - there would be a Gemini Program or something like it to allow the momentum of flight operations and astronaut training to continue, but no - there would be no such thing as a competitive program. That would short circuit the Apollo

program. Chamberlin was quite aggressive in those days; he spent a good deal of his time at McDonnell stimulating analyses of how the Mercury system could be modified to justify the Gemini approach. It was really Chamberlin's personal momentum, I think, that really put the Gemini concept over, although later Chuck Mathews was brought in to complete the program, operationally.

STG initially conceived the Apollo program as a lunar orbit mission first and a landing afterwards on a step-by-step basis, building on experience. This was the way the RFP was originally issued and it was on this basis that the contractors, who were already preparing their proposals, were expected to respond. At this point there was a major redirection by NASA Headquarters on this concept (presumably in response to the Executive Branch of the Government) and at a weekend secretive meeting at Wallops Island (a meeting called by Abe Silverstein, who was then Director of Technical Activities under Glennon), Gilruth, Faget, Chuck Mathews, and others, determined that it was feasible to enlargen the objectives of the Apollo program. The outcome of this, which was rather significant, was the decision to land on the moon as a primary objective of the first flight. Since the RFP had already gone out, and called for a circumlunar mission first and then a buildup to a landing later, all requirements for propulsion, weight, modular construction, etc., were completely changed. With a landing objective, it would be necessary to make provision for a landing vehicle, an ascent and descent propulsion system, a higher velocity reentry capability, and many other things. The RFP requirement would have to be changed to provide an adequate response. There was a frantic upgrading the RFP. A change notice was issued and the responders were asked to study the impact of a landing on the

moon. It was quite a scramble, I am sure. They came back in Oct with their responses which incorporated this new requirement, and this is the way the program has gone ever since. I was a member of the team evaluating the Apollo proposal.

The Apollo effort was managed by a group entirely different from the Mercury or Gemini groups and was staffed by different people. One of the objections that some of us had was the complete lack of provision for integrating in the Apollo design the operations experience of Mercury and Gemini. That mistake is now being paid for, and has been paid for many times over. The Operations Division discovered early in the Mercury program that ~~when we began to~~ in order to properly train astronauts, ~~when we trained~~ and flight controllers as to how the system would be flown, how to operate the system in flight, and how to respond to emergency procedures, etc., ~~in order to be able to train them properly -~~ we had to be thoroughly familiar with how the systems operated. We could not get this total understanding from the designers in the STG, or people who monitored the contractor designers, nor could we find many of the contractors' design engineers who truly understood how the systems operated in flight. Even though they were the designers, they were not operations-oriented. Although they designed to specifications on input-output functions of their systems, they were not prepared to understand the many ramifications in the operation these elements, particularly as integrated systems. Any time the experience of personnel who actually operate the systems is ignored or is not plowed back into a new design, a very dear price is paid.

This was one of my original objections to the Apollo design approach and the Apollo management system.

I can honestly say that I probably will never again have a job as interesting or challenging as I had in STG. I was not initially SV-3 equipped to handle the full range of technical aspects of that job, although I managed to grow into it. I had the advantage of a good deal of experience in management in research activities so I understood personnel problems, which is really management's big job anyway. It was not hard for me to assume this responsibility and I found a great challenge in it and found it very rewarding because I was able to do things and contribute to things that no one had ever done before.

I left the program quite reluctantly in March 1962, but stayed on through Scott Carpenter's flight. I went back to LRC to do some advanced planning work for Hack Wilson on Project Fire. The reasons I did not come to Houston with MSC are primarily personal. The work was excellent, the people were first class, and it was difficult to make this decision.