SPACE STORIES:
ORAL HISTORIES FROM THE PIONEERS OF AMERICA'S SPACE PROGRAM

An Oral History Project conducted in conjunction with the Houston Chapter of the AIAA and Honeywell Corporation

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Interviewees:

Guy Thibodaux, Maxime Faget, Paul Purser, Clotaire Wood, Josephine Dibella, Adelbert Tischler, Harry Finger, Chris Kraft, Eilene Galloway, Paul Dembling, Ed Cortright, Walt Dankhoff

Official histories often make it appear that nations make big decisions based on thorough research and understanding. But when the individuals intimately involved in those big decisions are given voice, a very different story emerges--one of hops and skips, personality clashes and chats between friends, and bootlegged designs that lead to billion-dollar programs. With funding from the American Institute of Aeronautics and Astronautics, Houston Chapter, and from the Honeywell Corporation, Robbie Davis-Floyd and Kenneth J. Cox have embarked on the project of collecting oral histories from a number of individuals who were intimately involved in the events leading to the formation of NASA and the early development of its space program. Our focus is not on the well-publicized astronauts, but on the inside stories of the engineers and administrators who worked behind the scenes.

INTERVIEWS 1 AND 2: THE SPACE CADETS
(Thibodaux, Faget, Purser)

Our first interview was with Guy Thibodaux, the engineer and rocket propulsion scientist responsible for the propulsion work on Mercury and many other space projects, at his home near Johnson Space Center in Houston/Clear Lake, on Sept. 9, 1996. The following day we met again at his home, this time to conduct a joint interview with Thibodaux and his colleagues Maxime Faget, who was instrumental in the design of the Mercury, Apollo, and Gemini spacecrafts and the early shuttle, and is widely considered the father of spacecraft design, and Paul Purser, engineer and manager at Langley Research Center in the Pilotless Aircraft Research Division, which formed the early nucleus of the space program. Brief biographies of these three space pioneers follow below.

BIOGRAPHIC INFORMATION
Joseph Guy Thibodaux Jr.
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Guy Thibodaux graduated from Louisiana State University with a B.S. in Chemical Engineering in January 1943. He immediately reported for Active duty as 2nd Lt. in the U.S. Army Corps of Engineers and was assigned as a training officer at Ft. Leonard Wood, Mo. He was transferred to the China Burma India Theater and assigned to the 45th Engineering Regiment, and built advanced fighter strips in the Burmese Jungle and worked on the construction of a road from Ledo, India to Kunming, China.

After returning home he was employed by the Langley Memorial Aeronautical Laboratory's Pilotless Aircraft Research Division (PARD) in Virginia, where in a period of three years he became head of all propulsion and pyrotechnic activities at Langley and its launching range at Wallops Island, Virginia. He pioneered the redesign and modification of surplus military rockets to enhance the quality and types of aerodynamic data from free-flying supersonic rocket models and wind tunnels. He was responsible for the development of high temperature ceramic heated jets, electric arc heated tunnels, hypervelocity impact research, high vacuum technology, thermo-physics research, electron beam radiation, and oxidation resistant coating and thermal protection technology using ground and hypersonic reentry vehicles. He designed and operated an experimental solid rocket manufacturing plant and produced some of the highest mass fraction design spherical rockets from his own patented ideas, and developed novel manufacturing techniques. He conducted research on many solid fuel rocket operational problems which only occur in free flight. In 1958 he was a charter member of a committee which eventually planned the transition from the NACA to NASA and its first years' programs. He was instrumental in starting the Scout, America's only all solid propellant launch vehicle, and the first one ever developed by NASA; he managed development of all propulsion and pyrotechnic systems on that vehicle.

In 1964 he became Chief of the Johnson Space Center's Propulsion and Power Division and was responsible for all propulsion, pyrotechnic, and cryogenic storage and supply systems, power generation and storage systems and hydraulic systems on all of America's Manned Spacecraft. He was responsible for the operation of large test facilities at JSC and White Sands, New Mexico, needed for the development, testing, and evaluation of these systems.

He retired in 1980 after completion of work on the Space Shuttle and was a consultant to various industry and government organizations on such topics as solid and liquid rockets, free flight techniques, safety and hazards, and H-bomb simulation facilities.

BIOGRAPHIC INFORMATION
Maxime Faget

Max Faget graduated from Louisiana State University with a B.S. degree in Mechanical Engineering (aeronautics option) in June 1943. He immediately joined the Navy as a Naval Reserve Officer assigned to submarine service. He then became employed at the Langley Laboratory of the National Advisory Committee for Aeronautics (NACA) in August 1946. He was assigned to the newly created Pilotless Aircraft Research Division (PARD), a division that was to fly rocket-powered models of aircraft and missiles at transonic and higher velocities to obtain aerodynamic data. During this period he did pioneering work on supersonic inlets and ramjets. He designed a compact (6-1/2"dia.) ramjet engine and a supersonic flight test vehicle which was powered by two of these ramjets. During a flight test in 1950 this vehicle accelerated under ramjet power in a climbing flight achieving an altitude of 65,000 feet and a velocity of M=3.2, setting unofficial speed and altitude records for vehicles powered by air-breathing engines.

While at Langley, he was appointed to the four man team that prepared the conceptual design and performance analysis of a research aircraft that could fly twice as fast and much higher than currently possible. The NACA then approached the Air Force to contract with industry to complete the design process and manufacture such an aircraft. This became the start of the X-15 program. Faget was also appointed the NACA member of the Polaris Missile Steering Task Group where he proposed the aerodynamic shape that was employed for the reentry warhead. During the winter of 1957-58 he conceived the design and started development of the one-man spacecraft subsequently used in Project Mercury. Both the Gemini and Apollo spacecraft are derivations of the Mercury concept. When NACA was notified that it was chosen as the cadre from which a new civilian space agency would be formed, Faget was appointed a member of the transition team.

After NASA was formed, Faget was assigned to the Space Task Group (STG) organized to manage Project Mercury. Although Mercury was the main task at STG, there was great interest in follow-on programs. Consequently he devoted a large part of his time to heading a design and analysis team exploring manned flight to the vicinity and the surface of the moon. Because of this and other NASA studies, President Kennedy was able to commit the USA to a lunar landing by the end of the decade. With the advent of Apollo, STG became the Manned Spacecraft Center (MSC). Faget was appointed Chief Engineer at MSC, responsible for the design, development and proof-of-performance of manned spacecraft and their systems. This responsibility included specifying the function and design of numerous engineering laboratories to be constructed as part of MSC. In April 1969, shortly before the first lunar landing, he organized a special preliminary design team to do an intensive feasibility study of a reusable manned spacecraft. This effort achieved program status when Johnson Space Center (nee MSC) was given formal authority to develop the Space Shuttle. Subsequently, Faget gave prime emphasis in his personal activities and those of the organization toward solving the manifold problems in the development of the Shuttle. He retired from NASA after the Shuttle successfully completed its second test flight in 1981.

In 1982 Faget and several Houston businessmen founded Space Industries Inc. (SII). SII designed the Industrial Space Facility (ISF). The ISF was to be a manned-tended orbiting facility to be used for experiments in a high-quality micro-gravity environment with special emphasis on material processing. Westinghouse became a partner with SII in a joint venture for financing, construction and operation. Significant backing was obtained for an initial deployment in 1992. However, the aerospace industry, Congress and NASA feared it would curtail the Space Station program and consequently the ISF was never deployed. SII then manufactured a wide range of experiment support equipment that was flown on numerous Shuttle missions. The most significant was the Wakeshield built for the University of Houston. This free-flyer was successfully deployed on two missions, providing the experimenters with an ultra-high vacuum environment for material processing.

BIOGRAPHIC INFORMATION
PAUL E. PURSER

Paul E. Purser was born and raised in Southeast Louisiana. He graduated from Louisiana State University in 1939 with a B.S. in Aeronautical Engineering. He took the Civil Service Exam that spring in anticipation of a major growth in NACA (National Advisory Committee for Aeronautics) during the pre-World War II period, and worked briefly as a Junior Inspector at Glenn L. Martin, Co. Baltimore on a twin-engine attack bomber being built for the French armed forces. In mid-October he received his NACA appointment and immediately departed for Langley Field.

During the prewar and WWII period, Purser carried out wind-tunnel research and evaluation work on practically every aircraft proposed for, or used in, WWII. At the end of WWII, he joined the Pilotless Aircraft Research Division (PARD) which was then being formed at Langley. There he and his colleagues carried out aerodynamic and structural research in flight using rocket-propelled models at Mach Numbers up to 15. Additionally, Purser headed up the development of various high-temperature ground facilities for research on materials, structures, and missile nose cones. During the major portion of the period between October 1957 and October 1958, he was a member of the small (12-man) team that conceived and "sold" the U.S. Manned Space Program and as part of the larger (75-man) team that planned and implemented the conversion of NACA to NASA.

From October 1958 to April 1970, Purser was Special Assistant to the Director of Project Mercury, which developed into the Manned Spacecraft Center (now Johnson Space Center). During that same period he continued his membership in the American Institute of Aeronautics and Astronautics (AIAA). In the early 1960s, he became a charter member of the American Society for Oceanography and a Member of the Marine Technology Society when the MTS and ASO merged. Also during the 1960s he was registered as a Professional Engineer in Louisiana and Texas. Purser was also invited to (and did) join 3 National Honor Societies Tau Beta Pi (Engineering), ODK (Leadership), and Sigma Gamma Tau (Aerospace Engineering.). During the 1968-69 academic year he was on loan to the University of Houston where, as Special Assistant to the President, he guided the development of the UH-Clear Lake Graduate Center.

Upon his retirement from NASA in April 1970, he began consulting in various fields trying to apply what he had learned in NACA and NASA. In addition to various consulting tasks in the oil & gas industry, this led to a 10-year stint as Staff Consultant to the NAE/NRC Marine Board, overlaid with a 5-year stint as consultant to the Stanford

School of Medicine Cardiology Division, about 5 years as a part-time Systems Engineer with the Gulf Universities Research Consortium (GUBC), and a 25+-Year association with CAPT W.F. Searle (USN-Ret.) on various tasks in the oceans industry. During this time he prepared and presented several technical papers at the Offshore Technology Conferences and the MTS Oceans Conferences.

INTERVIEW #1

Interviewee: Guy Thibodaux, NACA/NASA engineer and rocket propulsion expert, former Chief of the Propulsion and Power Division at the Johnson Space Center, Houston, TX.
Interviewers: Robbie E. Davis-Floyd and Kenneth J. Cox
Interview Dates: Sept. 9-10, 1996

This seven-hour long taped interview has been edited by both interviewers and by Guy Thibodaux himself for clarity, organization, and flow. Thibodaux (aka Tibby) has also added in extensive supplementary commentaries and additional information, all of which appear in italics or parentheses. [Editorial comments from Robbie Davis-Floyd or Ken Cox appear in brackets.]

GUY THIBODAUX: It's been a long time and the story hasn't been told about how the space program and NASA really got started. There are quite a few people still alive who are responsible for getting them going. I have a list of those that I know who are still alive with their addresses and phone numbers that you can use to contact them regarding further interviews.

I've never seen any references to the fact that some of us spent a lot of time up in Washington, going through the Pentagon like we owned it, coming up with what became the space program. It's not documented, you see. I think the history, from the time the Space Task Group came down to Johnson Space Center is pretty well documented (even if it is wrong*)*. What I am really interested in is covering that gap, the transition between the NACA and the events leading up to that, up to the early years of the Space Task Group.

ROBBIE DAVIS-FLOYD: That's what we'd like to focus on too.

GUY: I talked to Paul Purser and Max Faget and they'll be down here tomorrow.

ROBBIE: Good! Ken Cox said that you yourself have some great stories.

GUY: Well, these are fairly interesting stories because most of what went on is undocumented. We never kept minutes at meetings. Most of it was in verbal reports to our leaders and the results which were achieved speak for themselves.

Personal History: World War II, Model Airplanes, and LSU

ROBBIE: Tibby, before we get into the space program, tell us a little bit about yourself. Where were you born?

GUY: I was born in the Louisiana swamps.

ROBBIE: Where in the Louisiana swamps?

GUY: I was born at the F.B. Williams Lumber Camp in the Atchafalaya swamp on the west side of Lake Verret. It is certainly a swamp. It was a big cypress logging organization. My father worked there. My

birthplace was registered as Napoleonville, Louisiana which is twelve miles north of Thibodaux, Louisiana on Louisiana Highway 1 which parallels Bayou Lafourche.

ROBBIE: Is that town named after your family?

GUY: Yes.

ROBBIE: Did you grow up there and go to school there?

GUY: No, we left there and moved to New Orleans when I was about five and I went to high school in New Orleans and later on I went to Louisiana State University. The interesting part of it is that Paul Purser, Max Faget, and I were all LSU graduates. Max and I were college roommates. We (Max and I) had a pact that at the end of the war, if we both survived, we'd get together and go look for a job together.

ROBBIE: What was your role in the war?

GUY: I was an officer in the Corps of Engineers and I served in the China-Burma-India Theater building a road from India into China and some advanced fighter strips. I was a white officer in a segregated Negro organization. I'm doing a lot of historical work on that right now, as a matter of fact.

ROBBIE: So, when you went to LSU, did you go all the way through and get your degree in engineering from LSU?

GUY: I had that before I went into the service.

ROBBIE: What was it in?

GUY: Chemical Engineering.

ROBBIE: What did you do when you came home from the war?

GUY: Well, then I came back and I was sitting at home one day and Max called me and said, "Hey, my dad said I could borrow his car. Let's go look for a job." His dad had a little '41 Chevrolet business coupe and it had airplane tires on it because you couldn't get tires during the war for cars. We went back to the university and we went to our various departments and told the department heads we wanted to go look for a job, and asked who we might talk to about getting a job.

ROBBIE: In chemical engineering?

GUY: Whatever, I thought chemical engineering.

ROBBIE: What was Max's degree in?

GUY: His degree was in Mechanical Engineering with an Aeronautical Engineering minor. Paul was the same way as Max--they were both in aero-engineering, mechanical engineering. Paul graduated about two years before, two or three years before we did.

I know Max as well as I know anyone and I knew him longer than anyone. When I met Max, he was a transfer from San Francisco Junior College. He was already a sophomore, but he was a freshman in

Military science. I was his platoon sergeant, and I thought he had two left feet! That's how I first met him. Later on we got to know each other fairly well. I'm not sure why, we were both about the same size, and we're both from Louisiana but he's not a Cajun. I am. I had to work to earn some of my school expenses and it took me four and a half years plus a summer school session to finish because there was one required course I had to have that I could not schedule because of my work. During the summer school session, Max and I roomed together. Then I had another semester that I had to finish so we roomed together again.

Comment: I think I first got to know Max because of Hank Bourgeois. Hank was a childhood friend who lived around the corner from me in New Orleans. He was a talented model airplane builder . I used to help him fly models in the huge Agricultural Auditorium building at LSU. Max was also an avid model builder and there were a few other cadets who shared the same hobby. Hank went on to become a Marine Pilot and was Pappy Boyington's wing man in the Black Sheep Squadron of WWII. Hank stayed in the Service and still built models, this time radio-controlled models. He retired, worked in the Aviation Electronics Industry and became mayor of some town in New Jersey.

KEN COX: OK, so you roomed together. That's where you really got to know Max.

GUY: We roomed together for two semesters and we used to wrestle and play handball, work out, and do all sorts of things together. I use to go up to the leper colony with him and spend weekends with him up there because they had a golf course, tennis courts, and a swimming pool for all the public health officers. It was only about thirty miles south of Baton Rouge. Max's father discovered the cure for leprosy. He served in the Public Health Service and was moved around the States to various Marine Hospitals. He (Max's dad) had been assigned to head up a leper colony in Carville, Louisiana. Max went to high school in Norfolk, which is right across from Langley Field. And he began college when his dad was in San Francisco. Max was very familiar with the Norfolk area. He used to build model airplanes and used to go over to Langley Field for model airplane contests with a friend, Woody Blanchard, back when they were high school kids.

There is an interesting story there, about how Caldwell Johnson [a technician who worked closely with Faget on spacecraft design for many years] got hired. The way they hired people at Langley was they went to these model airplane meets because they knew that the kids who built the best model airplanes were the best craftsmen. When Langley was hiring craftsmen, what they would do was go and check up on these kids who were winning all these model airplane meets. They would find out the kids who were building the best models and those were the ones they would try to convince that they ought to apply for a job to work in the shops out at Langley.

So, they convince Caldwell he ought to apply for this job. Ray Sharp is the guy who hired him--he was the head administrative honcho back at Langley. In order for Caldwell to meet the requirements for the job, he couldn't be color-blind. So Caldwell was rejected by the doctor and he went in with his rejection slip, whatever it was the doctor gave him, and talked to Mr. Sharp with his tail hanging down between his legs and his chin down and said, "Mr. Sharp, I don't qualify for a job. You can't hire me." Sharp said, 'What the hell's the matter, son? He said, "I'm color blind." Sharp looks at the map on the wall and points over to the Pacific Ocean and says, "Son, what color is that?" Caldwell told me that everybody knows the ocean is blue, so he said, "Blue." He said Sharp pointed to another ocean and said, "What color is that, son?" "Blue." He said, "Hell, you ain't color blind, son. That doctor doesn't know what the hell he's talking about. You passed!" And he scratches it out the rejection and said, "You're hired!"

Something like that you never could do today. Caldwell didn't even finish college, in fact. Here he is, this designer of American spacecraft, but he never finished college. He went a couple of years,

maybe. He went through the apprentice school and became--back then the top trades were engineering draftsmen and metal model maker and instrument maker. He was one of the top students in the class, so he became an engineering draftsman. Then he headed the section that designed all the little models we used to fly out on Wallops Island.

KEN: I didn't realize it, but apparently model building, in those days, early maybe mid-50s or right after World War II, was really an area where a lot of people became craftsmen.

GUY: Yes, but during the 30s, 40s and 50s, they knew how to design airplanes. Model airplanes had to fly. Then you knew what had to be, and you knew about wing sections, and you knew about stability and dihedral and all that other stuff.

There is a story about Max that is priceless. When we first went up to Langley, Max was still a big model airplane builder. His friend Woody Blanchard eventually became the one of the top model airplane builders in the United States for a number of years. We'd all go to meets together. I was what they called the gopher. You see, in order to win prizes you had to fly in a lot of different events. When you launch the airplane, it was up in the air for a long period of time. If you waited and ran and chased it down and came back--you had to fly it three times, then you'd have get to other events. The gopher was the guy who goes for it and gets it to bring it back while the other guy is entering some other event.

Anyway we were going up early in the morning to a meet, the New York Daily Mirror Flying Meet. It was held at the Grumman Airfield in Bethpage, Long Island. We were riding up to New York, and we got up real early in the morning. The back of the car was filled with model airplanes. Max and I and Woody went to eat breakfast on the main street in Newport News, Virginia. At that time in the morning the street was totally empty. This car is a Chevrolet Coupe and it's canary yellow, just as bright as can be. We walked over and had breakfast. Woody and I reached into our pockets and said, "I got the exact change, Max. You don't have any change, do you?" He said no. And we said, "Well, we'll leave it and you pay for the bill. We are going to go back to the car. Meet us there." The car was parked right across the street.

Woody and I went and sat in the car. No Max, No Max. No Max. No Max. *(laughter)* Pretty soon we look around and here comes Max walking right past the car. Woody starts to holler, but I said "Shhhh!" Max walked right past this canary yellow car. He walked all the way to the other end of town and came back. Then, when he came back and it had gotten a little bit lighter, he looked at us with this big grin and said, "Where you guys been?"

He just had his head in the clouds. He was thinking about the meet or something. He was that way about a lot of things. When we went to Langley, it was almost six months before he could find his way out to work. I used to have to tell him how to get to work every morning. *(laughter)* We roomed together and he'd get up in the morning and he'd go in the bathroom and he'd blink in the mirror a few times. Next thing I know, he's back in the sack!

KEN: What was it that attracted you early to a friendship with Max?

GUY: I don't know. We got along. We didn't have too many common interests. We did share interests in sports. Max had been a quarter-miler--I wasn't very athletic. I was kind of small. I couldn't play with the big boys, but I did intramural pretty well. I shot on a varsity rifle team, I ran cross country, I played softball. Max and I used to wrestle a lot and play handball, one of the things that we liked. I love handball because you have to be ambidextrous. You have to develop coordination on both sides of

your body. We played a lot of handball together. We were both very similar students. We didn't take our college work that seriously. *(laughs)* We were pretty damn independent. No one told us what we had to do. The professors couldn't manage us very well.

If we got a lousy grade (C) it was usually because the professor didn't like us and he couldn't manage us or that we just weren't interested in the subject. That didn't bother us. My whole attitude was I was there to learn something, not there to get a fancy grade. I found a lot of people who got fancy grades but who didn't know a damn thing except they memorized stuff by rote and they could answer the test questions.

Oddly enough, I think with our school records, even though we had reasonable records, they'd have never hired Max and me today. We couldn't even qualify to be hired over here [at JSC] today. That's a fact. No one would look at us if they looked at our college transcripts and resumes--neither one of us were honor society types or anything else. We flunked out more roommates than anyone I know because we never studied. When it was time for final exams we used to always go to the pool hall and shoot snooker all during the week while everyone else was boning up. I never took notes in college. I'd come home at night and I'd try to remember what I had heard and I'd do all my note taking at night. If I couldn't remember it, it obviously wasn't very important.

KEN: You must have a pretty good memory.

GUY: I had a pretty fair memory. Somewhere along the way I understood what I was good at and what I wasn't good at. I was fortunate enough that the profession I took up was one which I was very happy I chose. The teaching methods they used in my department were better, far better than anything else I've seen. We were taught to think. The problems we had to solve were thinking problems, not multiplication and addition and stuff like that. We also taught team work. All of our labs were done by teams of people. We rotated the leadership and somebody had to figure out how to adjust all the valves so the thing would flow in the right direction. Somebody had to collect the samples. Somebody had to weigh them. We had to give assignments.

Guy *[comment]: I had always thought I wanted to be a chemist, but at a career counseling session my senior year in high school, the Dean of Engineering at Tulane University convinced me that Chemical Engineering was a much better way to go. Like Paul, I couldn't afford the tuition at Tulane. I also needed help to earn some money to help pay for my education. My dad knew some politicians who helped me get a NYA Scholarship at LSU which paid me 30 cents an hour. That paid for all my food, and I earned some extra money during summer vacations.*

I never regretted the decision. The professors in the Chemical Engineering Department were outstanding. Most had industrial as well as academic experience. As one never knew what kind of industry he would work in, the curriculum had to be very basic. Paul Horton, Jesse Coats and Arthur Keller were my principal teachers. We were taught to think. Methodology was much more important than getting the arithmetic right. In Chemical Engineering Lab, we, with a few professionals, operated an experimental sugar mill for the Louisiana Cane Growers Association and got valuable experience. And with grants from the local petrochemical Industry, we did experiments using the type of equipment used in that field.

The cost of doing business was paramount and almost every project involved what is now known as "cost engineering." While each student was required to write his own reports of the experiments we did, we were taught teamwork. Each assignment had a leader who was required to assign tasks to the other students on the team. I learned that to solve a problem, you didn't start at the beginning, you

started with the end result that you desired and worked backwards from that. The professors required enough from each student that merely to pass was an accomplishment. Less than 20 percent of those who wanted to be chemical engineers in their freshman year graduated in that field.

GUY: We had a lot of real problems. Nothing imaginary. The old department head just made us think. While we did our work as a team, we each had to write our own individual reports and submit them. They all had to be typed. He was a real great teacher, very demanding. He didn't put up with any bull crap. He, I could tolerate, because I knew what he was up to. The other guys who told me I had to keep this notebook and I had to be neat and look this way--I didn't pay much attention. *(laughs)* Max and I are really not that great for neatness.

Robbie *(laughing):* What did your dorm room look like?

GUY: When I was a cadet it looked great because I would have been walking drill tours if it wasn't. It was spit and polished and shined and the bed you could bounce quarters off of and the whole bit. But after I got out I got out of that--well, it was sanitary. It was a hall, that's what it was. We lived in a stadium. They have cheapest rooms on the inside of the stadium. They didn't even have windows to the outside. So it was kind of dark and dank and mildewy. There were three of us--Bobby Dreher, I guess it was. Billy Drake was another one. Billy is dead. He was a Grumman test pilot that got killed out at Edwards Air Force Base flying a new Grumman airplane. Bobby works up at Langley. They had trouble trying to keep up with us because they couldn't shoot snooker during final exam week. They had to study. I could never do anything like boning up. If I didn't know it before I went in there, I wasn't going absorb it in a two or three night period. I've been that way all my life. I was fortunate that I was born with two great assets. I was born lazy and with no ambition. *(laughs)*

ROBBIE: You sure went a long way for somebody who is lazy and with no ambition!

GUY: Those are two of my greatest assets. Because I was lazy, I became, I think, an outstanding supervisor because I didn't mind letting other people do the work. I didn't have to do the work, or try to be smarter than the sum of the guys in my division. But I knew enough to guide them. And because I had no ambition I was never a threat to any boss I had. I never walked over any of them. I walked around quite a few of them, but I never walked over any of them. And I never worried who got credit for the work. I think I parlayed those two things other people think are not too hot into a pretty good career. And I had an awful lot of fun doing it. I don't think anybody could have worked in anything more exciting than Max and I and Paul did. We were right in the forefront of everything. We always had the best tools. We had tremendous support in everything we did. You just couldn't ask for a better deal.

KEN: Paul went to LSU also. Did you know him there?

GUY: I didn't know Paul that well. I knew of him at school, but I didn't know him. He graduated two or three years ahead of us. Because he was working at Langley, he had an exemption from going into the service because he was working on defense related research. So, Paul didn't go into the service. By the time we had gotten to Langley, Paul had been working there for six years and had kind of gone up the ladder. Gilruth had brought him in--Paul had headed up the small wind tunnel there at one time. He also headed up the fiscal office, the payroll office at Langley one time. We got Paul's name from the head guy who taught Max aero-engineering.

The guy who headed up the aeronautical department at LSU was an old German from World War I, Ernst (Fritz) Maser. He designed some real fancy airplanes back in the '30s. The fastest airplanes in the world had been designed by this guy. He came over to the United States and became a professor

at LSU. He had a very small organization. He never had any more than ten or twelve students. He handpicked all of his students, so he knew they were all topnotch people before he accepted them. He knew they would get through.

Fritz designed racing planes on the side for Harry Williams and Jimmy Wedell during the 1930s. These usually won the Cleveland Air Races and were piloted by Wedell. They were built in Patterson, Louisiana on Bayou Teche at a site which is now the Louisiana State Air and Space Museum. Harry is the son of Frank Williams who owned the logging operation where I was born.

ROBBIE: And he was your professor?

GUY: No, he wasn't mine. He was Max's. I knew him and I worked with him. I got to know him fairly well back in the early '40s. Fritz was head of a Navy and Air Corp Cadet training program at LSU. As I already had my commission, but had not been called to active duty because I was being allowed to complete my education, I was hired at the enormous salary of $5.00 an hour to give these cadets military training. That's really how and when I got to know Fritz.

ROBBIE: And he taught Max aeronautics?

GUY: He taught Max aeronautical engineering, as well as Purser. So he gave us Paul Purser's name and I got a few leads in some sugar companies and various industries from the head of my department. It turns out that we were on our way to visit our other roommate who was a pilot on the Franklin D. Roosevelt, a new aircraft carrier just commissioned. Billy was still in the Navy as a Naval pilot. He was at Quonset Point, Rhode Island. (Billy later became a Grumman test pilot and was killed in an airplane accident at Edwards Air Force base.) We took off in this little car and we headed off to Quonset Point. On the way there we stopped in Norfolk, Virginia and Langley Field, Virginia

ROBBIE: Paul was already at Langley?

GUY: Paul had been there for about three years before the war. He was there all through the war and had been there three years prior to the war. Max and I spent almost three or four years during the war in the Army and the Navy during WWII. Paul didn't go because he had an important civilian job. He got a deferment and didn't have to go into the service. They may have inducted him as a private or something but never sent him.

ROBBIE: So you drive up there in Max's father's car, and say "Hey Paul, we're here?"

GUY: No, he didn't know we were coming up. We got there and the first person we met was Adeline. She was a pretty little thing. She was the receptionist in this fancy building. There was a rotunda and it had paintings of the history of flight on the large hemispherical dome. There was this big circular table and she sat there where you went in. She took one look at us and kind of turned her nose up for some reason--I guess because we looked like two bums. We were wearing very loud Hawaiian sport shirts and either kakhi or navy gray work pants . We had opened-toed sandals with no socks on. I think we slept in our clothes. We weren't anything special looking. (Later on, she must have changed her mind because she asked us to give her a ride home after work.)

But they didn't give a hoot--they didn't care about that. They were totally informal. The whole operation was informal. Paul never wore a tie, in fact. He suffered with the heat so always in the hot summer he had a big towel wrapped around his neck. Whenever we had any distinguished visitors, he used to keep a old seersucker coat hanging on a tree in his office. This office was just one big office with

everybody in there. Paul had a desk at the head of the room. He'd go grab some kid who had a tie and say "Hey, I want to use your tie" and take the tie off him and put it on and go to the meeting if he thought he had to be dressed up. *(laughter)*

ROBBIE: So when Paul saw you guys what did he say?

GUY: He was enthused because here are two young fellows who had engineering degrees looking for a job. They had hardly hired anybody with degrees. Most of the people had gone off to war. It wasn't that easy to get good people. He made us an offer right on the spot. He said, "Sure, we'll hire you" and we said, "We'll let you know in July," and we went up to visit Billy up in Quonset Point. We spent a little time up in New York City and did a few other things. After we went back home, we decided one day, "Well, we didn't get any better offers," so we called up in July and said, "Hey, we'll report the first of August." That's how we got to work up there.

ROBBIE: What did he offer you?

GUY: A job working in the Pilotless Aircraft Research Division—PARD—under Bob Gilruth. He said he needed someone--both of us worked in propulsion for a time. This was the first place where they had offered us a real job that sounded interesting. They hired me to work on rockets and they hired Max to work on a type of propulsion called ram jet. Paul said to me, "You are a chemical engineer. We need someone who can work on things called liquid rockets." Well, once I got up there, I found out that liquid rockets were not what we were supposed to use--solid rockets were so much easier and cheaper, and we could handle those so much better.

ROBBIE: Is that what got you interested in propulsion?

GUY: Yes, I got interested. I taught myself with a bunch of books from the library. I set up test facilities and later on, I built myself an experimental solid rocket plant so I could try out some of my own ideas on high performance solid rockets that I had patents on. They had a bunch of surplus military rockets we were working with--little teeny things between two and five inches in diameter. I got interested in them and a lot of other things. I was part of a service organization--I provided a service to all the people there. I was not in the forefront like the other people. I kind of worked in the background.

Design and Experimentation at Langley/PARD

GUY: I found out a lot of things--that if they would let me make changes in the rocket designs, fix the rockets up and do things a little bit differently, I could help enhance quite a lot of the aerodynamic data we got. So I got in the business of cutting rockets in half, building bigger ones, gluing two of them together, putting them in a lathe and cutting them down, doing all sorts of things to change their performance characteristics, which would help the engineers get better information. We developed a bunch of little techniques.

One of Bob Gilruth's real strong points was that he believed in absolute simplicity. He believed in using your head rather than the machine to do things. He would say, "Use your head!" I learned a very important lesson which I began to put together from him--that passive systems are much more difficult to design than active systems. Passive systems are where you press the button and everything happens according to the laws of physics and chemistry without any intrusion of anything--a valve that you have to adjust, something that has to turn something else off or on--he was real great for that. He never let you use a lot of complicated devices.

ROBBIE: Why? Because there would be more stuff to break?

GUY: Yes. They cost money and they can go wrong. They can fail. So what you do is use the laws of physics and chemistry and put those to work for you so that everything happens the way it's supposed to happen on the way up. With the basic design, you design that into the system so that nothing active had to come in and intrude on it. It's done--when you press the button, everything is preordained that is going to happen, you see?

I caught onto that real quick and that's why Gilruth and I got along real well. One time he had us study the dynamic qualities of an airplane to make the airplane stable. If you pulled back on the stick and then you release it then your airplane goes through oscillations, and those oscillations tell you how stable your airplane is. He didn't want anything to go bad so I said, "I can fix you up. I can put little rockets about so big--about a half inch in diameter and four inches long--that fire at right angles to the model, and that's going to knock the nose down and make the thing oscillate. I can set those so they go off in one second intervals using delay fuses. I'll put eight or ten of those and I'll fire them all from the ground and they'll all go off at different intervals, so as the airplane is slowing down, you get the entire speed range from supersonic through subsonic." We started doing things like that.

There were a lot of other little things that people wanted. One of the guys said there was an aerodynamic quality they wanted to measure called damping in roll. He came and talked to me about it. He said, "I have to have something to make the airplane spin but I can't use the rudder to make it spin." He said, "If I had something to spin it—" and I said, "Then I'll design you a rocket to spin it, and I can tell you how much force the rocket's using to spin it--will that help?" and he said "Sure." So I designed those things--a lot of little things like that.

One of the guys in the wind tunnel called me one day and said, "Hey, we'd like to study something in the spin tunnel, but we can't. There are a lot of things we can't do." The spin tunnel is a vertical tunnel --the air goes up. You throw a model in there and then you put it into a spin and you blow the air on it, enough so it keeps it floating there, you take pictures of it as it floats around as it spins. He said "Well, you really can't tell very much about the aerodynamic forces on there or the other forces, because they are all in the wash. It spins around, it's nothing but the air that is displaced that it's spinning back into. I can't tell what forces and what direction you need to apply to cause the airplane to recover from a spin—" But he said, "If I had a way that I knew what the forces are that cause the recovery, I might understand what I have to redesign in the airplane to make it recover from a spin." And I said, "Well I'll design you a little rocket that can provide a known force and moment you can put in there." And I built little rockets that fire a couple of seconds. They could fire those at all the various axes and cause it to de-spin. Then they could study the spinning characteristics, the forces and the inertia that it went through in the tunnel. That was a big help.

ROBBIE: You built rockets that were tiny?

GUY: They about a half inch in diameter and an inch long and produced three ounces of thrust for two seconds. They were mounted on a little model airplane in the tunnel and what they would have inside was a little switch. The tunnel had a large solenoid coil in its throat. When you energize that magnetic coil, you close this little switch to fire those little rockets without any external wires into it. There was a small battery and initiator inside the model.

We did all sorts of things. It was a kind of free-swinging outfit. When we tested airplanes in the wind tunnel you had these turbojets hanging on there, but there was no exhaust coming out. With no exhaust coming out, it doesn't give you true conditions. The exhaust acts like a big solid body. It's like

trying to stick your finger into a hose. The jet exhaust pushes the free stream back out. John Stack asked my advice on installing something to simulate turbojet exhausts, so I suggested a hydrogen peroxide mono-propellant system which would give about the same exhaust characteristics as a turbojet. I helped John Swihart and Jack Runkel, both of them in the 16-foot wind tunnel, get this started.

I'll tell you a little story about my rocket plant. That's a good one. You see, Lewis was the propulsion research center and Langley was supposed to be in aerodynamics.

ROBBIE: What were you doing at Langley instead of Lewis if you were in propulsion?

GUY: I was supporting Wallops Island and Wallops Island used rockets all the time. I wanted to build this rocket plant. I had some ideas about a brand new spherical rocket that I thought would have some advantages. I wanted to be able to build one to prove it. So I needed to build a rocket plant. Headquarters would absolutely not approve of building a rocket plant at Langley field. They said, Oh no, only Lewis could have a rocket plant.

Bob Gilruth came to me and said, "My signature authority is worth $999.99. If it's over $1000, you'll have to go to headquarters for approval. Can you buy every piece of equipment you need for that rocket plant for under $1000 per piece?" I said "I think I can." He said, "Don't worry about the building. We'll call that a model assembly shop or something. We'll build you the building. That's no problem." I had to take some of the low bidders for equipment I needed. But, I built me a rocket plant. I bootlegged it! The next year, because of what I did with that plant, headquarters decided to give $225, 000 to build me a good one, a bigger one.

ROBBIE: So in other words, you bootlegged it and then once you were doing it, then they gave you money for it! What did you do with that rocket plant?

GUY: I built these nice rockets.

ROBBIE: The round ones?

GUY: The round ones.

ROBBIE: What did they do, how did they perform?

GUY: They were the highest mass fraction rockets ever built in the country at that time. I could build them in any size. I built a lot of them for research--for studying meteors coming to the earth at extremely high speeds. They were very unique little things. Then they were used as retro rockets and the Japanese copied them. I got to go to Japan to give a paper. They started copying all the ideas that I had and a lot of other people got into the act. I designed and built another non-circular, non-spherical rocket that had some rather unique qualities to take advantage of filament wound rocket cases.

ROBBIE: Are those designs still used or have they evolved into new designs?

GUY: They've evolved.

Development of the American Space Program: Early History

GT written commentary:

To understand the space program you have to go back to a number of events during World War II and the ensuing years. Rockets have always been an interesting subject, but other than some crude early designs by Congreve and Goddard, they had little practical application other than for holiday pyrotechnic displays. In America our use of rockets during World War II was restricted to small solid propellant rockets like the Bazooka (an anti tank weapon), barrage rockets, some air to ground weapons and a few applications in naval warfare. The Germans, under the leadership of Walter Dornberger and Wehrner von Braun, developed a long range liquid rocket bombardment system. This story is told in Dornburger's book, which is entitled V-2. At the end of the war, Operation Paperclip brought many of the German scientists from Penemunde to America to continue their work on rocket-powered weapons, first in El Paso, Texas, then in Huntsville, Alabama.

At the end of WWII, Robert Rowe (Bob) Gilruth began to use free flying rocket powered models to conduct aeronautical research at transonic and supersonic speeds at a remote location off the eastern shore of Virginia named Wallops Island. This started in 1945 with a small group of engineers at the National Advisory Committee for Aeronautics (NACA) Langley Research Center (LaRC) called the Auxiliary Flight Research Section. The work expanded and grew into the Pilotless Aircraft Research Division (PARD) in 1946.

In the ensuing years numerous things happened. In the interests of obtaining higher and higher speeds, PARD developed a number of simple multi-staged solid propellant rocket vehicles which had hundreds of successful launches with few failures. The International Geophysical Year brought together a number of scientists interested in the upper atmosphere. These simple launch vehicles were an ideal way to obtain the extremely high altitude this group was looking for. Bill O'Sullivan was PARD's representative on this International Geophysical Year Committee. Some others were James Van Allen of the University of Iowa, I.M. Levitt of the Fels Planetarium, and I believe S. Fred Singer of the University of Maryland. PARD engineers worked with these scientists to customize various systems including rockets launched shipboard and from high altitudes on helium-filled balloons (Rockoons). This work led to the discovery of the Van Allen Radiation Belts, Standard Tables of Properties of the Atmosphere, etc.

With the Cold War heating up in the early and mid1950s, the emphasis shifted to Intercontinental Ballistic Missiles (ICBMs). The multi-staged research vehicles that we were launching were capable of achieving the speeds and altitudes near those reached by ICBMs and thus were ideal research tools to study aerodynamic heating and heat resistant materials needed to protect the warheads during atmospheric reentry at high speeds. Max Faget was on a Fleet Ballistic Missile (Polaris) committee and Paul Hill was on a similar committee for the Army's Pershing Missile.

The models were getting larger and more expensive. Paul Purser was given the task by Bob Gilruth to look into development of ground facilities to do more detailed studies of high temperature structures and reentry thermal protection systems and materials. This led to the development of high temperature ceramic heated air jets, electric arc heated air jets and chemical jets (rocket exhausts).

Further work resulted in facilities led by Bob Jewell which prepared oxidation resistant coatings such as borides, carbides, nitrides, oxides and silicides using a vapor deposition technique by bubbling hydrogen through metal halides and passing them over induction heated carbon models.

Later on we became involved in electron radiation in space using high voltage cascade rectifiers to accelerate the electron beams, micro-meteoroid damage using light gas guns developed by Alex Charters of Aberdeen Proving Grounds, high vacuum technology, and thermo-physics.

All of these technologies were at the forefront of those needed to understand what was required in order to send things and people safely into space. Every bit of this was conceived and executed by a small handful of people in NACA's Pilotless Aircraft Research Division at Langley Research Center, and the supporting effort of everyone at the Center. This led management to recognize the expertise of this group in technologies which were precursors to going into space. The effort supported our country's ICBM program and had a great influence on the shift from all liquid propellant launch systems to all solid propellant launch systems, along with the knowledge as to what the real size and weight of the hydrogen bomb was.

GUY: The space program really got started back in 1957 with NACA, the National Advisory Committee for Aeronautics. I worked for the NACA in PARD, and what we did was aeronautical research using free-flying rocket-powered models, and that research had a great influence on the ballistic missile program, including the shift from big liquids to all solid.

With these small launch vehicles, we were getting up into the ionosphere, and at the same time getting a velocity that was short of orbital velocity, but pretty well up there. Just about the time Sputnik flew, in October of 1957, the Air Force had a program which was eventually called Dynasoar. Dynasoar was either a winged bomber or a winged orbiting space surveillance aircraft. There were two versions of it --one with a semi-global range--it could fly halfway around the world. Then they discovered that with available propulsion technology you could actually go into orbit and fly it all the way around. The Air Force wanted to develop this winged space bomber to be able to fly and bomb anywhere in the world.

That program was the outgrowth of something happening in Germany in World War II. The Germans had developed the V2s, and were looking at the very large V2 they called A4 (or A10). Its purpose was to be able to bomb New York from Berlin. The way Dynasoar came into being was that the Army had gotten all the German scientists at the end of World War II. It had gotten von Braun because the Air Force did not exist at that time--it was still the Army Air Corps. The Air Force, once it did exist, was kind of miffed because the Army had gotten the group who were in the business of developing rockets which could bomb cities in direct competition with bomber airplanes.

Since the Army had von Braun, the Air Force decided on a little one-upsmanship. So they imported von Braun's boss. That boss was one of the German generals in Hitler's high command. His name was Walter Dornberger. He's the one who wrote the book called V2, about how the V2 developed in Germany. He had a PhD in engineering and oddly enough was a very delightful person. He had a very nice quiet personality--not what one would expect of Hitler's generals. The Air Force set him up at Bell Aircraft Systems in Buffalo, New York.

ROBBIE: What year was this?

GUY: This must have been in the early 50s. He was Chief of Research, Chief Scientist at Bell Aircraft. The Air Force had some studies which were conducted under the code names Robo and Brass Bell. They were top secret studies. They were basically on glide bombers, not like Dynasoar. These studies eventually grew into a proposal to build some of these things.

In October 1957, the NACA was asked by the Air Force to convene a group of people and to take a look at this program they later called Dynasoar and to advise them of the feasibility of doing this program, possibly as a continuation of the high speed flight research program past the X-15. People from throughout the agency were invited to the NACA's Ames Research Center at Moffett Field, California to sit in on these discussions. It was the week when Sputnik was launched. The U.S. had its

own satellite launching program—Vanguard--which was the responsibility of the Naval Research Laboratory.

That grew out of a program called Viking, which was a relatively large liquid-fueled sounding rocket that could probe the upper atmosphere and gather all the properties of the atmosphere--density, temperature, radiation and various other things that scientists were interested in measuring. This program wasn't doing that well at the time. It was having many failures and was way behind schedule.

Anyhow, we got out to California--I don't know the names of all the people who were present there, but the senior guy from Langley was a fellow named Floyd Thompson. He later became Director of Langley. He was a very, very interesting person in a lot of ways. He had a lot of talent, and then he had some shortcomings later on, I discovered. His shortcomings were that he didn't know how to choose people to run the various organizations that were part of Langley after people to began to leave and branch out. (To be fair, his problem there could well have been that almost all of the really innovative people who were capable of leading the Center into the Space Age had been assigned by Bob Gilruth to the Space Task Group.) Other than that, he was a real great guy.

And, there was myself, Paul Purser, Max Faget, Adolph Busemann, a scientist who we imported from Germany who was a supersonic and hypersonic aerodynamics specialist. I don't remember everybody from Langley. Dr. Dryden, who was head of the NACA, was there. There was Milton Ames who was head of the aeronautics programs for the NACA, and Clotaire Wood who was Dr. Dryden's special assistant. He was a young fellow who took care of a lot of Dr. Dryden's agenda.

There were many, many people from Ames Research Center. There was Harvey Allen who later became Director of Ames, and Al Eggers. These were the two who were responsible for the blunt body ballistic missile nose cone re-entry development.There was Walt Williams (Paul Purser's classmate from LSU) who at the time was Director of the High Speed Flight Research Station at Edwards Air Force Base, California, and later became NASA's Chief Engineer and Deputy Director of the Manned Spacecraft Center for a while. I think his assistant De Beeler was also there.

I don't remember all the other people, but since it was out at Ames there were quite a few Ames participants. There was a young X-15 test pilot named Neil Armstrong who was there too. We all flew out to California to Ames Research Laboratory near Mountain View. It's in the San Francisco area. We sat around for about three or four days and had a number of technical discussions about what the Dynasoar should do and what it should look like.

Another fellow named Hartley Soule from Langley was also there. Hartley was the guy who started the Flight Research Program at Edwards Air Force Base. The last big one they had was the X-15 Mach 6 research airplane. And Bob Piland was another young fellow who worked with us. (I can pinpoint the date because Piland had his 30th birthday while we were there. It was also the 30th anniversary of Hartley Soule's working for the NACA.)

We looked at Dynasoar and saw that there were a tremendous number of obstacles, but none of them were insurmountable. They were strictly engineering problems that somehow or another, if you worked hard enough and you did enough research in some specific areas, could be overcome. Nothing seemed to violate any laws of science as we understood them.

Ultimately we have proven that--the shuttle is nothing but a very large Dynasoar. *[Note: Max Faget disagrees with this assessment.]* When you really look at it, the Dynasoar had a similiar shape. We didn't have very large launch vehicles at the time. And the shuttle basically had wings just about like

the Dynasoar. It glides back in just like the Dynasoar was supposed to do. You see, the Dynasoar was feasible, it's just that there's a lot of what I call collateral technology that has to be developed. You want to do things, but in order to do them something else has to happen to allow you to do those things. You have to develop the materials and understand the aerodynamic forces, heating, propulsion, structures, materials and guidance and control. And all those things you need have to be small and lightweight, and have to use little power and last a long time unattended .-

Well, from 1957-1970, when we were working the space program on Mercury, Gemini, and Apollo we were developing all that technology which would allow Dynasoar to happen *[i.e. the shuttle]*.

We had a few things we were interested in doing. I was interested in building an all solid-propellant launch vehicle. You see, most of the launch vehicles are liquid-propellant except that suddenly they shifted over from liquids into solids for the ballistic missile launch vehicles, for a lot of very good reasons. Many of the reasons were the results we got from launching these multi-stage solid-propellant rocket vehicles at Wallops Island. We demonstrated a very high degree of reliability and very simple operation. Their simplicity, lack of much ground support equipment and instant readiness makes them much easier to do than the big liquid system.

Max had gotten interested in putting a man in space as a result of discussions with Al Eggers and in addition to looking at Dynasoar. And it looked much easier to do than Dynasoar. The easy way looked a lot like this ballistic missile nose cone technology. We would build a little blunt nose cone and it didn't have to have all the controls or everything on it. It was going to be a very, very simple thing to do compared with doing a great big thing like Dynasoar and really a way to get man into space in a hurry.

So out there at Ames, Max and I cornered Dr. Dryden in the lobby and we were doing a little bit of lobbying ourselves, telling him that we were not going anywhere fast and if he would just give us a chance, we could develop this little launch vehicle--which later on became a four stage solid propellant rocket satellite launch vehicle called Scout. (The Scout had a very successful history. It's no longer flown but it was flown up to about two years ago before the program was cancelled. During its lifetime it had the most reliable launch record of any launch vehicle.*)* And Max said we could put a man in orbit if we were given the authorization to do so.

GT commentary: I picked the Scout concept up in July of 1957 after coming back from a big rocket conference in Denver. I saw that the Navy was developing something called the Jupiter Jr. Jupiter was a big liquid rocket that was being developed by the Army in Huntsville. The Jupiter Jr. was going to be something the Navy would put in the water and that would float like a buoy with the nozzle down, and be launched like a plumb bob flying right out of the water. Another option was to launch it from the deck of an aircraft carrier. It was about the largest solid-propellant rocket that had been developed in the country at that time. The program was supplanted by the Polaris later that year.

I had looked at that and I looked at some other rockets that were available, things that were being developed for the upper stages of the Vanguard, which was going to be the first satellite put into space in the Navy program. And then there was another program called Hermes which had another large solid rocket. And taking a look at the size of these things I could see that when you put a third stage in the stack, they all come up almost to a perfect match where each upper stage was compatible with the total stages under it without relying on a monster size booster first stage. So you have three of them already being built and you don't have to spend any money to develop them and repeat a lot of mistakes--you only have to develop the fourth stage. (The third stage in this case.) I looked at the propellants available, and at the case manufacturing technology and other possible improvements, and

did a few calculations to show that four properly designed stages would put a lot more into orbit than the Vanguard.

And Dryden said well, Eisenhower had told him that the Naval Research Laboratory was the only one that was going to put a satellite into orbit. (Later it turned out that he had to recant, because the Navy got so far behind that von Braun launched the first little satellite with the Redstone and two stages of solid propellant rockets.) And then Max talked to Dryden about putting a man in space--he wanted to get a manned space program going. Dryden didn't take too kindly to that. I think his comments were, "Shooting a man into space is like shooting a girl out of a cannon"--or something like that! And frankly, Al Shepard's flight was about like that. I think when you really get honest about it, it was more about PR than anything else.

So Dryden said NO we are not going to do any of that. So we got back to Langley and talked to Bob Gilruth and Bob said, "Well, you guys go ahead and work on it." He said, "We won't tell anybody." Most of the greatest work we ever did is what we called "bootlegged." We got it started before we ever had authorization to do it. We would develop the concept, prove that it worked, and after we proved that it worked by bootlegging it, why then they'd give us authorization to do it. We always did think like that back in the old NACA days.

The NACA

GUY: The NACA was a very unique organization. We probably had somewhere around 7 to 8 thousand people in the organization--scientists, administrative people, and crafts people. We had a lot of very skilled people who could make anything you wanted. The machine shops--they could make anything that anybody could conceive of. We had instrument machine shops that could make instruments. We were completely self-sufficient, our organization, pretty much. We did not have to do a lot of outside contracting except for maybe the large construction. To manage that organization of 7000, the total headquarters/professional staff was 58 people in Washington! The proportions are quite a bit different these days. But the NACA was not a political organization. It wasn't big enough that anyone would want to grab it. It really didn't have to be defended, and there were a lot of people who supported it because it did nice work.

I wrote a Foreword to the commemorative album for the NACA's fifth reunion. It will describe what the organization was really like and what made it great and why.

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NACA 1915-1958
Reunion V
Galveston Texas
October 19-20, 1991
Foreword, by Guy Thibodaux

In the winter of 1915, Congress passed an Act attached as a rider to the Navy Appropriations Bill creating a new organization known as the National Advisory Committee for Aeronautics (NACA). The initial annual budget was $5000. This organization was to become the finest ever created by the U. S. Government. Its charter was "to supervise and direct the scientific study of the problems of flight with a view to their practical solution, and to direct and conduct experiments in aerodynamics." The Act provided that the governing body be composed of those acquainted with the needs of aeronautical science, either civilian or military, or skilled in aeronautical engineering or its allied sciences. Vannevar Bush described the NACA as "unique among Federal Agencies in that its controlling body served

without salary and had been composed of men of such high character and distinction as to render it completely free of political influence."

The committee was limited to fifteen members. As the work of the Committee grew, it added working groups also known as Committees to advise in those major subdivisions of the science of flight such as Propulsion, Stability and Control, etc. These were further divided into subcommittees depending on the degree of specialization. The members of the Committees usually served as subcommittee chairmen. They were served by an Executive Secretary who was a member of the Washington Office Technical Staff. All members were cautioned that they had been chosen for their personal reputation and expertise and were to represent their opinions and convictions rather than those of the organization that employed them.

The product of these groups were the Resolutions, suggesting that specific areas of research should be increased or added. The minutes of these meetings were circulated to the Field Centers. It was left to the organizations and individuals what course of action to pursue and what resources would be allocated in support of these resolutions. Two documents were necessary to apply the resources of the various organizations, the Research Authorization (RA) and the Job Order (JO). This lack of unnecessary paperwork and bureaucracy left the individual researchers free to pursue the major goals of the agency without encumbrance. The absence of a body of documents and procedures regulating all of the Agency's operations allowed the leaders to make the tough decisions based on what they felt was good for the Agency. Often their interpretations of the rules could be construed by others to violate other existing Government regulations. Individuals were recognized for their skill or expertise rather than the positions that they held. The engineer, scientist, administrator, designer, craftsman, or technician were all equal members of the teams that sprang up in response to the Agency's goal.

Henry Reid once said that a great error was made when his title was changed from Engineer-in-Charge to Director. He remarked that it was impossible to direct those bright, talented individuals who had attained national and international reputations in their fields and the accolades of their peers. Leadership and respect in the NACA was not conferred. It was earned.

The change in world events leading up to World War II resulted in a major expansion of NACA's facilities at Langley Field, Virginia. The center of the aircraft industry was moving from the east coast to the west coast. A new research center called Ames Aeronautical Laboratory was opened at Moffett Field near San Francisco in California. Another, called the Lewis Flight Propulsion Laboratory, was opened at Hopkins Airport in Cleveland, Ohio. The Langley Memorial Aeronautical Laboratory furnished the nucleus of people to supervise the design, construction, and staffing of these new centers. Further expansion in the postwar era resulted in the establishment of the High Speed Flight Research Station at Muroc, California and the Wallops Research Station on Wallops Island, Virginia. In this expansion, the NACA grew from one research center and a Washington office staff of 5 in 1939 to three Field Centers and two Field Stations numbering almost 7000 with a total headquarters staff of 135 by 1945. The agency had but one attorney on its staff, a General Counsel.

The greatness of the Agency resulted from many factors. It had outstanding leaders who were men of vision and integrity. It did not compete with its major customers and in the same vein, it had no real competition from its customers. The NACA never designed a commercial or military airplane. The large, complex research facilities were too expensive for any one company to afford. The NACA operated as a self-sufficient organization reporting to the Independent Appropriations Office of the House of Representatives. It justified its own budget, allocated its own resources, designed and contracted for the construction of its facilities, developed its own research equipment and techniques, and scrupulously followed the rules of competitive acquisition of goods and services.

The pay wasn't that great, but the working conditions were outstanding. During the lifetime of the Agency, not one member of the leadership ever left seeking higher pay or a more satisfying work environment. At Reunion II, Bob Gilruth said that he would have been willing to work for room and board because it was such an honor to be accepted to work for the NACA after graduation. The "cream rises to the top" was true at the NACA. Everyone likes a winner. Those individuals who possessed the imagination and ingenuity to suggest practical ways to carry out the NACA's mission had little trouble gaining support for their projects. They found an eager group of equally talented people from all support areas to assist them. The Agency never gave out trivial pieces of paper or hardware for individual achievement. The rewards were more responsibility, the ability to work on the most exciting projects, and the respect of their peers. It was said that one had to be superior just to work for the NACA. While these same bright, talented people were highly individualistic and had egos, these egos were suppressed for the good of the Agency. Everyone who had thoughts or ideas to contribute could be heard. There was little turnover of the most talented people. Long-term professional and personal friendships were developed that exist to this day. These are some of the reasons why after 33 years large groups of us gather to renew these friendships and pay tribute to the organization which all of us are proud to have served.

Dr. Dryden expressed great concern that the environment that made the NACA what it was would be radically changed in the ensuing years under NASA. He feared that much of the spirit that was the NACA would be lost. The legacy of the NACA was passed on to the next generation under NASA with the talents and integrity of those who were the NACA's leaders. Most of us participated in the transition from the NACA to NASA. The NACA spirit was carried into the Space Age by people who were NACA-trained, educated, and developed. The second generation is now retiring, and it remains to be seen how many of Dr. Dryden's concerns are realized.

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GUY: The NACA was a funny outfit. I worked there for 17 years and I don't know anybody who ever got an award from the organization, as I explained in my Foreword. The way you were awarded is you got to work on the best jobs. You got ideas heard, you got promoted. They didn't give you a piece of paper or a plaque. Everybody knew who was doing the job and what would happen. Then, if you did something good, everybody in the organization who was good wanted to work with you on your team or on your ideas. It was "the cream rose to the top." That's the way the organization worked and everybody understood that. No one had to worry about anybody patting them on the back because they knew what they did and everybody else knew what was done. Occasionally somebody got a big award from some place outside the agency. A modern parallel to the way the NACA operated is what happened in the computer industry in Silicon Valley in its early years.

Caldwell Johnson was another one of the wonderful people in the outfit. He designed spacecraft. He said his neighbor always asked him, "Well, I see all these military people getting all these outstanding ratings and superior performance awards--how come I never see any of you guys ever get one?" Johnson said, "Hell, you got to be superior just to work for the NACA!"

Somehow or another back in March of 1958, someone in the Eisenhower administration apparently decided they wanted a space agency. The troops in the trenches didn't really know that much about it. But I think the NACA headquarters was told that they were going to become the nucleus of the space program. Most of that is a result of the work that we had done at Wallops Island with Bob Gilruth and his Pilotless Aircraft Research Division--that's why we became a space program--the aeronautics part of course was fairly well established throughout the rest of the agency.

Formation of the NACA Space Committee

GUY: Gus Crowley, who was the deputy under Dryden, formed a little committee in the middle of March, 1958. Its job was to take a look at the NACA's role in space. *[Shows a two-page piece of paper]* That's the committee that was formed--it's a little innocuous-looking memo.

R *(reading the memo)*: It says that the people appointed to the committee were Bruce Lunden from Lewis, Walter Olsen from Lewis, W.J. O'Sullivan, Jr., Paul E. Purser, Joe A. Shortal, Guy Thibodaux, Floyd L. Thompson. J. W. Crowley from NACA headquarters, Ray L. Zavasky, secretary, Clinton E. Brown, Ed C. Buckley, Robert Crane from Ames, and Max Faget and R. L. Krieger. What's his first name?

GUY: Bob Krieger. Bob's dead and Bob Crane's dead. Quite a few people have died. It was a long time ago. We got together--

ROBBIE: Where did you meet?

GUY: I think we met the first time at Langley. It's been 50 years, I don't remember exactly. There were many, many meetings that came on after that. This grew into almost a permanent type of affair. And not all the people from the original group stayed with the group. There were various reasons why a lot of them didn't continue and various reasons why there were substitutions.

ROBBIE: And what was the name of this group?

GUY: It was a group to prepare a NASA space technology program for budget purposes.

ROBBIE: Was this the Space Task Group?

GUY: No, this was a year before the Task group. This was just a group of people mostly from Lewis and Langley who they thought were leaders in their fields who could come up with the program, and with enough convincing arguments, be able to get funding for it. It turns out, Lunden went to this one meeting. Ted Olsen was not a permanent member of the group. Bill O'Sullivan stayed with us. Paul Purser stayed with us. Joe Shortal was not a member--he didn't stay with us. Joe was our Division Chief at the time. He had to run the Division. Floyd Thompson was an Acting Center Director at the time so he didn't stay with us. Gus Crowley stayed with us. He was up in headquarters and we reported to him and Dr. Dryden. Zavasky stayed with us. He was a kind of top administrative assistant. He'd pull budgets together and he did a lot of other things. Clint Brown stayed with us.

Here are the addresses of all the people who are still alive and their phone numbers. Josephine Dibella was Dryden's secretary, either Dryden or Crowley's secretary. She's still alive. The secretaries usually know more than anyone else about what goes on.

ROBBIE: That's for sure!

GUY: Clotaire Wood was Dryden's special assistant and it was me, Max, Paul. Zavasky was the top administrative guy. The two guys from Lewis, Ted Olsen might have come up once or twice with us. Abe Silverstein, who was the Director of Lewis, realized something big was going on, and appointed himself in place of these two guys in this group. He was the acknowledged leader of the group at that time. Thompson appointed Bob Gilruth in his place and Bob was the Number Two guy in the organization at the time.

The other fellow who was added on there was Adelbert O. Tischler. *[**ROBBIE:** We have subsequently conducted interviews with Clotaire Wood, Josephine Dibella, and Tischler].* He was my counterpart from the Lewis Research Center. There was Edgar Cortwright. He was another real bright guy. He was an outstanding speaker and was on this committee. He became some kind of Associate Administrator in Washington. Then they appointed him Director of the Langley Research Center for a while.

Ed Buckley was Chief of the Instrument Research Division and he elected not to go. He sent his deputy, Mort Stoller, which was a super choice, although Ed would have been a great choice himself. Solid guy. Both of them later became Associate Administrators in headquarters at one time. Mort was very super guy. I didn't really know him (Mort) that well. The few times we talked I felt he was very astute in almost every facet of what we discussed.

Bob Crane from Ames continued on but because he was so far out in California and he didn't have a lot of money to travel, he didn't attend an awful lot of meetings. Later on, he became Assistant Director for Space at the Ames Research Center. Al Eggers was the guy who worked with Harvey that developed this blunt body re-entry nose cone theory. Al Eggers came up only once or twice. Krieger didn't participate. Krieger was running Wallops Island, although he did participate in some other activities relating to this group--on occasions we had special assignments.

The other guy who came up there, Charlie Zimmermann, was added to this group. He didn't take anybody's place--I don't know whether he was Chief of Staff or what but he was the guy who found out everything going on in the Pentagon and let us know about it, as far as I remember. He had a little petty cash fund we could throw chits in and take out cash for taxi fares and things like that. I really don't know everything that everybody did. They all somehow did something they were supposed to do!

There was an area called Stability and Control where Zimmermann was assigned to work. He had several new ideas. One of them was an airplane with a circular wing . Another was riding a thrust vector. If you had a controllable thrust vector passing through your center of gravity and it exceeded your weight, you could just take off and fly anywhere you wanted. Bell made a jet pack which accomplished it (best known as Captain Keds Rocket Belt) and people rode on top of rotating propellers which had lift in excess of a man's weight.

Max Faget was very active on this committee and I don't know if Paul was that active or not. Paul was kind of Gilruth's Chief Executive Officer. He did everything Gilruth didn't know how to do or didn't want to do. Gilruth had some things that he was super at that he loved to do, but like all of us, we can't do everything and he knew who to choose to do all those things that needed to be done that he wasn't going to mess with. Paul was that type of person--in addition to being very good in his own field as a scientist, he was good at all kinds of planning and administrative stuff.

In addition, Bill O'Sullivan was our resident egghead. They call them nerds these days. He was a kind of science type. He's the one who came up with this great big balloon, this hundred foot diameter balloon we launched in space called Echo. I don't know if you have ever heard of that. You could see it from everywhere. It was a real bright star and we had two of them up at once.

ROBBIE: What did they do, monitor?

GUY: Well, you could monitor radar signals, radio signals actually, sort of like a passive communication satellite except satellites now act so you can send the signals to them, amplify them and retransmit them. It was fundamentally something that everyone could see in space. It was a lot of

good PR as well as for measuring the density of the atmosphere because the number of molecules up there is what slows the thing down so much. It was measuring the decay rate. It was huge and it weighed practically nothing, so it had a very measurable rate at which it could come back into the earth. There were a lot of things you could do with it. So it actually did something.

ROBBIE: And it was good PR?

GUY: It was big! Everyone could see it and the fact that you could bounce a radio signal off it--well after the Russians launched their Sputnik, someone drew this a cartoon--it showed Sputnik and our balloon like two children in baby buggies, and Eisenhower says to the Russian guy, "Ours can talk!" I could still pinpoint the exact day, the first time I came down here to Texas, that I had eaten a barbecue dinner over at a friend's house, because that night at dusk I was watching and both of these two balloons crossed right overhead. There was only one time over that place that that could happen. I could go back and track down the date and hour.

Well, anyway, basically the task of the members of this committee was to find out what was going on in the military and the DOD that was space-related and see if those were the items that we wanted to budget. What we did is we caught an airplane from Langley on Monday morning, we went up to Washington beginning in April , almost every week through October, and we spent four days a week in Washington. I will tell you about that, too.

ROBBIE: When you would tell your wife you were going to the meeting of this group, what would you call the group?

GUY: I didn't call it anything. I was just going to NACA headquarters to work on the space activity. If it had a name, I am not aware that it had a name. *[In the following interview, it becomes clear that the informal name of this committee was the "Space Cadets."]* We were not a very big formal organization. The other thing is I don't think you'll find any minutes to the meetings. Everything we did was verbally reported to our leaders until later on when we came up with the budgets. Then all our input was fed into Ray Zavasky who pulled the whole budget together and published a little booklet for Congress. We didn't have a name and if we had a name I don't know what it was. All I know was we were trying to pull together a space program for the NACA.

Basically we were cloistered. Nobody in the NACA headquarters except for Crowley, Dryden, and maybe Ira Abbott, who was one of the three senior people up there, and Clothaire Wood actually knew what was going on, and we did not speak to anybody else. We had a room up on the top floor. It was a big conference room. It might have been Dryden's Executive Conference room or something. We worked out of that.

ROBBIE: Are we still in 1958?

GUY: Yes, this is ’58, from March through October ’58. And usually we'd spend one day back at Langley trying to keep the store, you see. Max was a Branch Head which is a pretty important job. Paul Purser was a Branch Head, and I had two sections in Paul Purser's branch, which is unusual, but we couldn't find anybody to do it, so I headed up two sections—the Rocket section and the Materials Research section in Purser's High Temperature Branch. We were doing research on all the re-entry stuff, which turned out to be very valuable--you know all the protection systems and materials, things like that. We were working on that.

So the members of this committee--we all used to go up to DC and stay in this fleabag hotel called The Francis Scott Key. It was near Georgetown University and it was very inexpensive because government per diem at that time was about $8 a day--or maybe $12 a day, I am not sure, and we couldn't afford very posh quarters. They didn't have any bellhops--you took care of yourself. But they were nice in a lot of ways. They had a stove and a refrigerator in every room and then something called an open-cycle air conditioner. They had a great big shaft that they put a big box of ice in and they blew air over it and depending on how wide you'd crack your window is how much cold air flowed out. Some places that infrequently use air conditioning still use that technique.

NACA headquarters was on 17th and F, I think. It was right around the corner from Lafayette Square, by the White House, in fact. The Madison House became part of the NACA headquarters. They stayed in that building, so it was right on the square there by the White House. We used to eat breakfast early in the morning and walk through Lafayette Square right past the statue of old Thaddeus Kosciuszco and the bums sleeping it off on the park benches, going to work. We were supposed to find out everything DOD was doing in space and bring that into NASA, the new organization. It was going to be the exclusive organization to work on space activity, but we didn't know it at that time.

ROBBIE: So in this little group, you were ultimately talking about founding NASA..

GUY: We didn't know it! Some people knew we were talking about founding NASA. Dryden knew it, I think, and Crowley knew it, but no one told us when we went up there that's what we were doing, that we were going to become NASA. We did find out later on. The fellow who wrote the Space Act was named Paul Dembling. He was NACA's General Counsel and the only attorney in the entire NACA practicing law.

Anyway, we had all the top security clearances that you needed to get in the meetings going on in the Pentagon. Charlie Zimmermann would give us lists of meetings going on in the Pentagon and the Navy department and over there at the Atomic Energy Commission. Somehow the word got to these organizations that we would be permitted to attend to these meetings to listen, be quiet, or participate in the meeting. Someone knew what was going on better than we did, apparently.

ROBBIE: Who would that have been?

GUY: It must have been Dryden and Crowley. Maybe Bob Gilruth did and Silverstein. I didn't know about it for quite a while. We'd go to all these meetings over in the Pentagon. I was interested in propulsion. That was my particular field since I headed up all the rocket work at Langley as well as the high temperature materials work. I got into high temperature materials research because rocket exhaust had the highest temperature of anything around at the time. So the earliest research work we did was using rocket jets with the materials and getting very, very high heat fluxes so you could test the high temperature materials. We'd go to the Pentagon, the Navy department or wherever these meetings were, and attend these meetings and find out what was going on and see what we wanted to include in the budget we were designing--what we thought we should budget for some of these items because the military was not going to be permitted to continue this work in these areas necessarily. Not as a space program per se.

ROBBIE: How did the people at DOD and the Pentagon feel about having to give up the space program to civilians?

GUY: I don't know how they felt.

ROBBIE: Did they ever express anger to you or frustration?

GUY: They never said anything to me and I don't think they knew what we were up to--the people at the meetings--anymore than we knew what we were up to.

ROBBIE: What did you think you were up to?

GUY: I had no idea.

ROBBIE: So you were just going into this blind, having these discussions and meetings but without--

GUY: Well, we were to come up with a budget as though the NACA was going to be a space agency and was going to be active in space. It didn't say we were going to be the exclusive thing in space. We didn't know we were going to be that exclusive about it at the time. We knew we were going to be active in it, but not exclusive.

Creating the Space Program: NACA to NASA

ROBBIE: OK, so you have this group and you're meetings go on through October and you come up with a budget.

GUY: Through October and we come up with a budget. The way we reported the facts is that every night we would walk back through Lafayette Square. There was a liquor store on the way home and Bob Gilruth and Abe Silverstein always had their room on the first floor at the old fleabag, the Francis Scott Key Hotel, next to the coffee shop. We all got a bottle and the young kids told the old folks how the cow ate the cabbage and what we wanted to do. We sat around and had a few drinks and we discussed what the daily activities were. There were no minutes at the meetings.

That's the way we communicated, at the hotel over a bottle. The young fellows would tell them what our opinions were about everything we'd gone through that day, whether we had been over at the Pentagon or out to the AEC and what programs we thought were good and bad. We would get some feedback. We did that almost every night.

ROBBIE: Can you pick one of those nights and recreate the conversation? Do you remember any of them well enough?

GUY: No, I don't remember anything specific that we talked about. We'd all go out and eat too. We would go to a lot of nice restaurants, even though we weren't real rich. The whole group would generally get together and we'd walk out or go get a taxi. Taxis were cheap in Washington. Sometimes we would go and eat at Jackie Kennedy's favorite restaurant, Rive Gauche, over there in Georgetown.

ROBBIE: And how old were you at this time?

GUY: I was 37, I guess.

ROBBIE: And how old was Gilruth?

GUY: He was only about 7 or 8 years older than me. I'm almost 75 and Gilruth is about 84 or 83. He got out of college about, he had a Masters degree, maybe 6 or 7 years before I did and went to college two years longer. He's probably 8 years older than me.

ROBBIE: And Dryden was not part of these discussions?

GUY: Oh, yes. Dryden was in on all of it. He wasn't part of the discussions nightly at the hotel, but was informed later on. Dryden got reports from Crowley or Gilruth or Silverstein. Sometimes we talked to Dryden but not that frequently.

There was a time I guess by which we knew we were going to become the space agency. The big question was, who decides the NACA would become the space agency? What other organizations are to be included ? There were no decisions made as yet as to what organization would comprise the space agency. One organization was the Naval Research Laboratory group that did the Vanguard and the Viking and did a lot of upper atmosphere research and science--would that become part of it? One of the decisions we had to make was we were we going to build another Center in the Washington area, and if so, where is that going to be?

The Army, the Air Force, and Wernher von Braun

ROBBIE: So your group finished getting the budget together?

GUY: We hadn't quite gotten that far yet. Dryden got wind that there was a big power struggle between the Air Force and the Army on account of the ballistic missiles. There were two competing programs, the Air Force Thor program and the Army's Jupiter program. They were both about the same size and intended to do the same thing.

I will say something else that should be interesting and it has nothing to do with this. As I mentioned earlier, the US Air Force was originally part of the Army (the Army Air Corps). When it became a separate branch of the service, at first it didn't have any organization. It didn't have any laboratories. The Army developed all of its stuff in-house through the use of arsenals. They developed tanks, and they developed guns and the Navy also had its organization that developed things. The Air Force didn't have anything. But the Air Force had some smarts. They understood that a big bureaucratic organization cannot lobby for itself. The Air Force didn't have any of this stuff, so what they did was they decided to get into bed with American industry. When Eisenhower left office, he was very concerned about that sort of thing, about the munitions manufacturers who worked with the German government.

But that's the way the Air Force came into being. They set up building their own thing. What they did is they gave contracts to industrial organizations and said, "You scratch my back, I'll scratch yours." The Air Force had all the industry and all the money in industry to lobby for the Air Force. The Army didn't have any of that, you see. It was its own bureaucracy. In the power struggle, the Army lost out on this big long-range ballistic missile. They were confined to what they called tactical missiles with a range of 500 miles or less.

But here you have this big organization down in Huntsville with von Braun building these Jupiters and Redstone ballistic missiles for the Army. The Defense Department didn't know what to do with it. Von Braun was one of the biggest proponents of space I've ever seen. He was a master at public relations. He understood that big bureaucracy can't be heroes in the public's eyes. Only people can be heroes. He was the guy who took credit for everything that went on down in that organization. Wherever he went, when he stepped off the airplane people wanted to talk to him. He <u>was</u> the organization. That's the way he played it and that's how he kept on getting budgets and how he got Congress to listen to him--by becoming an international hero. Very few know how to deal with that, but he understood that.

ROBBIE: Did people that work in his organization who had actually done some of the work he was taking credit for, did they resent that or did they understand it?

GUY: No, no, that was all part of the deal. They understood that, I'm pretty sure. The upper hierarchy understood that, anyhow. He was always on what I called the "borscht circuit," giving speeches at lots of rubber chicken, mashed potatoes and peas dinners. He was out selling space and missiles. He was a super salesman. That is what he was doing. He was selling himself, basically, but selling the program with himself. In fact, no one even knew who his deputy was. I could have talked to 95% of the people in the industry and ask them who von Braun's deputy is and I would say 95% even of key people couldn't tell me what the man's name was. He's the guy (Eberhard Rees) who kept the store when von Braun was on the borscht circuit. All the Germans, he kept them in line. He was a very mild, meek little guy, at least outwardly. Anyway, they understood the name of the game. It was to their benefit. I don't think any of them resented that.

I will tell you a story about going down to visit Dr. von Braun in Huntsville. He didn't know what we were up to either when we were working on that committee. I think by the time I went to see him, I did know what we were up to.

When Dryden got word that he was going to have to take in von Braun's organization, which was the part of the Army Ballistic Missile Agency that later became Marshall Space Center, he asked me to go down there to Huntsville and case the joint. That was probably in July or August of 1958. At the time I was a GS-15--that's the equivalent to a colonel in the Army, so it shook them up that I was the only person on the airplane. I had my own private airplane with a GS-15 pilot flying me into the Redstone Arsenal airport. That kind of shook them up a little bit--protocol you know. They were supposed to have at least a bird colonel meet me at the airport and show me around.

I went down there and found out how many people the Army was going to keep. I didn't ask about that--the way I went about talking to people was to find out what was pretty much part of the Army and what was part of the Redstone or Jupiter and the other part of the program that von Braun was involved in. The Army had small launch vehicles and small tactical weapons systems and anti-aircraft missiles. They had two separate organizations going. Von Braun headed one and somebody else headed the other.

ROBBIE: And they were going to split because the Army was going to move out of space?

GUY: They were going to split. The Army didn't know they were going to be told to split but they were distinct and separate in a way that you could divide them pretty easily. Maybe some people were a cross between both and they could settle that later on. I think I found out they had somewhere between five and six thousand people in von Braun's operation. Boy, Dryden was real excited because this thing he was going to have to take on was almost as big as his whole outfit. I don't know how many we picked up, probably around five thousand people we picked up when they created the Marshall Space Flight Center. It was a very interesting time.

Von Braun didn't know what I was up to but somehow or another someone sent the word that he was supposed to be nice to me. He met with me in his office and then we went to the executive dining room and had lunch. I had the funny feeling when I walked with him--as I walked down the hall with him it was as if I started to see all the Germans standing at attention clicking their heels and bowing to him even though they weren't. They all froze as he walked out. If you ever experience that it is a very eerie feeling when you walk down and all of a sudden you can see all them pop to attention--you know how

the Germans used to click their heels and bow like the Japanese did? You could sense that that was going on even though it wasn't. And then when I got to the executive dining room, no one could pick up their fork and start eating until he started.

I will tell you another interesting story about how hierarchy works. I was up at Bell Aircraft one time and I was eating lunch with Walter Dornberger and Bill Gisel. Remember I told you earlier that Dornberger had been von Braun's boss at an island off the European coast where the Germans developed the V-2s. Of course, Dornberger had reported directly to Hitler. He didn't have anybody between him and Hitler. Von Braun happened to be up there at Bell that day and their eyes met, and all Dornberger did was raise his hand and crook his index finger and von Braun came over and stood at attention and clicked his heels and bowed. I thought that was kind of interesting—a graphic demonstration of how the hierarchy worked.

Anyhow, I came back from Huntsville and gave Dryden a verbal report on that and he was surprised he was going to have to take on so many people because that operation was two-thirds as big as the whole NACA was at the time.

And then later on, myself, Joe Shortal, and Bob Krieger, and Ray Hooker--Dryden sent us down to Cape Canaveral because we were looking for launch sites, for launch pads. We all went down there and we talked with General Yates who was the commanding officer at Cape Canaveral at the time about launch sites and I took a look at some of the ground operations and watched a Jupiter launch.

Later on, by the time October came along, we all had our input in as to what we wanted to do. We wanted to start Scout, we wanted to start Mercury, I wanted to start large solid rocket programs. There were a number of liquid rocket programs that were ongoing that the military had that we were going to pick up. There was a lot of science work that went on too that we picked up at the time, mostly things as a follow-on to the International Geophysical Year from the scientists who participated in that program.

Gilruth's organization had been doing very similar work with sounding rockets. Bill, our resident egghead, had been our delegate to the International Geophysical Year which was a year set aside to study the upper atmosphere. That's where he had gotten the idea of the big balloon. Later on the Mercury program got started and we got the Scout program going.

Formation of the Space Task Group

GUY: March of 1958 was when our committe started meeting in DC. We became the space agency on October 1, 1958, when Congress authorized the creation of NASA. We had been bootlegging the space program from October '57--the time we were out at Ames with the Dynasoar thing--until '58. We were doing all the in-house study --getting prepared, finding out what it would take for us to accomplish all these tasks we wanted to do, how we were going to go about it, what the thing is going to look like, and how tough it might be to do it. We all worked on various aspects of those programs--the Scout and the Mercury program were the big things we did right in our own organization. Various other people worked with the people on space science and application. *[See the subsequent interview for more detail on this time period, and on the early work of the STG].* By the time October '58 came along and the Space Task Group was formed--

ROBBIE: Now tell me how the Space Task Group was formed.

GUY: This is the thing that followed the creation of NASA. They needed to have an organization to run the Mercury program. They weren't going to let the Center run the space program, it was not going to be part of Langley. Langley was more like a research outfit. The other thing that came into being was the creation of Goddard. Some of the folks involved in this exercise *(pointing to the list of people on the committee)* and other people they brought in actually had looked for an area to build Goddard. There was a farming cooperative called Greenbelt Cooperative. They had some farmland up there between Washington and Baltimore called Greenbelt, Maryland--a farm co-op. That's what was chosen as the site for the Goddard Center.

ROBBIE: What was the purpose of Goddard, what was it for?

GUY: For space science, basically is what it was supposed to be for. The Space Task Group was originally to be assigned up there. The person who created the Space Task Group was the Director of Langley. He didn't need anybody's permission--he just wrote a memorandum to create the Space Task Group and signed it "Floyd Thompson." *[Note: Gilruth actually signed the memorandum.]*

ROBBIE: Why was the Space Task Group needed? You guys already had your jobs at Langley.

GUY: It needed to be identified as an organization that was going to manage this very large manned space program distinct from Langley. Headquarters was going to be involved in a lot of things. Langley had never been involved in public affairs, the whole bit. At Langley we didn't have any Public Affairs office--we didn't need one. The work we did, we thought spoke for itself. We didn't have astronauts. There was going to be this big hullabaloo about this space program so they needed a separate organization.

And Thompson was very magnanimous. He vacated buildings for the Space Task Group and gave them space to house their offices over there and assigned people to the STG. He had a cute little way of doing things--Bob Gilruth's memoirs kind of allude to it. Thompson said, "Bob, you can have a lot of people but what we are going to do is for every one you take, I'm going to give you one." So you have a balanced organization, I guess, was the inference--you are not going to grab up all the good people. [Note: This was also the policy between NACA Headquarters and the Centers. Whenever Headquarters wanted to pick some bright youngster and offer him a job in Washington, the next one they needed was the Center's choice.

ROBBIE: Take the ones you want but I'll give some I don't want.

GUY: For everyone you take, I'll get to give you one. It's like choosing sides in a kid's baseball team. Gilruth mentions that.

ROBBIE: And did he actually do that?

GUY: Yes. All the people who came down here [to JSC] were pretty proud of coming down here but not all of them knew which group they were in--the ones Gilruth picked or the ones Thompson made him take.

ROBBIE: They didn't know whether they were chosen or sent! *(laughter)*

GUY: No. Most of them were very good but some of them were dull and not very bright.

The Leaders: Bob Gilruth, Abe Silverstein, and Joe Shea

GUY: I have something else you can borrow but you have to make a copy. I'd like to get it back. It's Bob Gilruth's memoirs telling about Wallops to Mercury, in other words, telling about the people. *[See the following interview with Thibodaux, Faget, and Purser for excerpts from these memoirs.]*

ROBBIE: I am so glad he wrote this because he has Alzheimer's now. How ill is he? Is there any hope of interviewing him?

GUY: No, he's totally out of it. That's a shame. But you can talk to his wife. He might have told her a lot of things. She's his second wife. His first wife died I think about 25 years ago.

ROBBIE: What were the things that Bob Gilruth was good at?

GUY: People. He was one of the greatest people persons you ever saw. He knew who to trust and who not to trust, who to appoint in key positions and how to let them do what they are supposed to do. He knew how to communicate with you. He was a very successful communicator. I worked with the man for most of my professional life, and he'd call me and we could discuss things. I had things that I wanted to talk to him about, and I'd say "I'd like to come down." He was never formal. When I first met him he use to come around--we weren't very fancy. We had old gray desks and no curtains, no rugs on the floor. Everyone had a wastebasket. He made a point almost every week to come by and talk to everybody in the organization. He always sat like he was sitting on a pot on my wastebasket and talked to me.

ROBBIE: He'd sit on your wastebasket?

GUY: Yes, he'd sit on my wastebasket.

ROBBIE: Without turning it over?

GUY: Without turning it over. It usually had trash in it--he'd turn it over if there was no trash in it. He never once told me what I should do. I never once left not knowing what I should do. I don't know how he did that. That's that way I felt. I knew whatever I did, if I chose to do it when I walked out of there I had his full, unmitigated support. I don't how he did that with everyone, but most of us, I think, kind of felt that way. He understood man-machine relationships, which made him great on the space program. He knew what the role of man was and how you were supposed to make his job easy, and what had to be done in order for a man to fly. He had a gut feeling about all those types of things. He was great at that. But I think his greatest asset was gathering the right people and knowing who to trust and who not to trust.

He was an absolute gentleman, but I could always tell when he was angry with someone. If he began to squirm during a presentation, I knew the presenter was in trouble. There's not that many people who have that knack, but those of us who worked very close to him always knew when someone was in trouble. His favorite expression when things didn't work out just right--he'd say "Well, I just don't think we had enough talent on that job." And that's about all he'd ever say. That was the way he dealt with things. He never demeaned anybody. He was just a real gentleman, a real great man. He was kind of the overseer, he and Abe Silverstein.

Abe was a very domineering person, very bright guy too, very talented guy. Abe was an aircraft propulsion type, turbo jet and other aircraft engines. He became Director of the Lewis Research Center which is in Cleveland. Abe knew what he wanted and he was very demanding. He was very gruff and

he tried to put the fear of God in everybody. Most of the people who worked for him really were afraid of him. Most of the people who closely worked for Bob Gilruth loved him, you know. None of us had any particular fear of him because he was such a gentleman in dealing with you.

ROBBIE: But people were afraid of Silverstein?

GUY: Abe was pretty much opposite. Everybody that worked for Abe was afraid to express themselves or to say anything about Abe. Abe is in his, probably well up into his 80s by now, and also an Alzheimer's victim. He was a tremendous individual, but he was so opinionated and gruff that he finally went back to Lewis because he couldn't get along with anybody in DOD. That's my personal opinion. He antagonized an awful lot of people. But he also did the country a lot of big favors. He's the reason we have liquid hydrogen rockets and liquid hydrogen technology, because Abe pushed that real hard.

KEN: Was Abe heading one of the NACA centers?

GUY: He was head of Lewis at the time this team--the Space Task Group--was formed. He decided that he was going to be the guy from Lewis. He took charge and he headed up the whole operation during this formative period. Gilruth was the Number Two guy. Silverstein was Number One. Then there were the rest of us.

KEN: Now, how was he to work for?

GUY: I found Abe very delightful to get along with. There is a very interesting thing. If you don't work directly for someone-- you see, I worked for Gilruth as far as I was concerned. If you don't work for the other guy, you don't really have to pay that much attention to him. I wasn't afraid of him. But everyone that worked for him was deathly afraid of him. He was very positive about everything, he was bright, talented, good and everything, and he wasn't as bad as Joe Shea, but he--

KEN: He had a command and control style.

GUY: Yeah, command and control. He wasn't very much of a politician. He was very abrupt and direct. I remember eating at that Armenian place in Washington, during those early days when we were attending meetings at the Pentagon, that I learned something from Abe Silverstein. I learned you always sit at a table--you never sit at a booth. It's far more comfortable to sit at a table. Abe would never sit in a booth. He always insisted we sit at a table.

ROBBIE: Why did he think a table is more comfortable?

GUY: You can get up. There is no person pinned in against the wall or anything. You've got a lot more room all the way around. It is much easier to sit in chairs. You can move the chair around. There are a lot of reasons I find it more comfortable to sit at a table than a booth. I learned that from Abe. If I learned anything from Abe, I learned that.

ROBBIE: Not what you'd expect.

GUY: Well, I learned quite a few things from Abe, I guess, like the fact that he could be buffaloed too. Like the time I went up to rescue the Scout from being transferred up to Washington, I had him right where I wanted him. They were going to transfer the Space Task Group up to Goddard. Abe wanted to put the Space Task Group up at Goddard where he could have it closer to Washington and have a little

more control over it. He also wanted to transfer the Scout up there. The Scout was something we were doing at Langley.

Abe had a committee that said there ain't no way on earth that we would ever fly that thing. It was too long and limber and we didn't know enough about thrust vector control systems and about thrust misalignment and solid rockets, and the thing would never fly. We didn't pay much attention to them because we knew better. I've done a lot of research work on various things over the years related to such a vehicle design.

So Abe wanted to move the Scout up to Goddard. He told Floyd Thompson he was going to move it up there. At the time we had budgeted about $27 million dollars for the entire program. There was also a lot of talk about the fact that the Navy had some obsolete, surplus Polaris missiles there, submarine-launched guided missiles. They had a bunch of old Polarises they wanted to get rid of and someone was trying to force us to use those old Polarises to make a version of the Scout instead of using the Scout itself--a very expensive move.

We had some meetings at Langley and I finally convinced Floyd Thompson that we weren't going to do anything like that. Thompson said. "Well, if you want to do this program you have to get the money." We needed about $8 million dollars to get this program started so Thompson said to me, "You go up there and talk to Abe and you get the money." *(Laughs)* So I went up there and talked to Abe and that was another interesting thing.

By the time, I guess sometime after October until the spring of the next year, at headquarters there were a bunch of people from the Army, Navy and Air Force who transferred to NASA to get a grade raise. They were very attached to military protocol. They wanted me to brief them and then they would go tell Abe about what was going on. They were going to be the intermediaries. I said, "No, we ain't gonna work things that way. I'm up here and I'm going to talk to Abe." They said, "You're only a GS-15 and we are much higher in the organization than you" And I said, "Well I don't care about that --I'm the Center Director as far as you're concerned. I represent Floyd Thompson and Thompson didn't tell me I had to talk to any of you people. I'm going to talk to Abe. And if you want to come, you'll have to get Abe to invite you." (He didn't invite any of them.)

That's the only time I've ever seen Abe Silverstein ranting and raving. He said "I told Floyd I'm going to transfer that thing up to Goddard" --the whole Scout program. I said, "What size boxes do you want them in?" He said, "What do you mean, boxes?" I said, "We don't have many people assigned to work programs full time. They are spread out all over. None of us want to go to Goddard so if you want the program, just tell me what size boxes you want us to put the documents in." And oh, he started ranting and raving and jumping up and down. That's the only time I've ever seen him flustered.

Afterwards he got calm, he said, "All right, you go back and you tell Floyd I'll send the money. But there's one thing you'll have to do before I send the money down. You are going to have to put a project office together and assign people to it and I'm going to have to know who is working on it." *(laughs)* So that was one of the agreements we had. And I went back and we created the Scout Project Office and that's what ran the program. That's how we kept the Scout back at Langley.

KEN: Oh, what a story!

GUY: That's when Bill Stoney got to be named head of the program--the first Scout Project Manager. That was the one time I had Abe where I wanted him, and I knew it. He doesn't remember that, you know. When I reminded him of that he said, "Oh, no, I would never do anything like that." I said, "How

come, Abe?" He said, "I would never take the baby away from its mother." *(laughter)* I didn't ask him if his middle name was Solomon. He was a good Joe, by the way. I think he was a good Center Director. He just had a different style of management.

In the same way that I got along with Abe because I didn't work for him, I never had to pay any attention to Joe Shea--I worked for Max, you see. You know, Joe could be very vicious too. I never knew Joe that well, but he was mean to everybody. He browbeat everybody. He was the most insulting guy I ever saw--I felt sorry for the people who worked directly for him.

KEN: Joe Shea was program manager for the early Apollo.

GUY: I could have never tolerated that kind of behavior. I wouldn't. He and I got along fine because I didn't have to put up with any of it. But the people that worked directly for him--

KEN: How did Max get along with Joe?

GUY: Oh, fine. You heard about the big foot race? Max use to jog every morning, run a mile every morning. Joe Shea ran too. So, they went to La Porte and they had a big foot race over there. They ran a mile. They bet that they were going to beat each other. I asked Max, "How fast are you going to run?" He said, "Well, I'm going to run under six minutes." I put a ten dollar bill on the table. I said, "If you run under six minutes, that's yours. If it ain't, you're gonna match it." *(laughter)* So George Low was the referee. They went up there and they ran the race. When they came back, I asked Max, "How did you do?" He said, "Well, I didn't do too bad. I came in second. Joe Shea came in second to last!" *(laughter)* To be fair, Max spotted Joe a few years.

There was another race. Pete Conrad had told Max he could run a mile in SkyLab. Max bet him he couldn't. Remember, in the Skylab movies you'd see Pete running around the ring up there? Well, Pete ran around the ring for a mile. He called down and said, "Tell Max I ran my mile!"

KEN: That sounds like Pete!

Paul Purser's Contributions

ROBBIE: You said that Gilruth delegated to Purser whatever Gilruth didn't want to do. What were Paul's strength and skills?

GUY: Purser was a very rapid writer and he was very concise. He could put it together real quick. He understood all the elements which you needed to get things done. And he could flood you with lots of ideas. In fact, it is in Gilruth's memoirs that he didn't know how to do any of this stuff. He wasn't a business type. He wasn't someone to build a big organization, to build a big empire. Paul didn't build empires either. Paul built Johnson Space Center. He was so good at it, the University of Houston wanted him on loan. So Gilruth let him go. It was a great loss to the Center for him to leave. The reason you never heard of Paul in any of the more recent activities is that Paul was on loan for the University of Houston and he's the guy who's responsible for building the University of Houston at Clear Lake.

One reason why Paul never came back to JSC was that he had a brain tumor. He was operated on and he was paralyzed on the left side of his face and it took quite a few years of therapy and reconstructive nerve surgery before he began to recover from that. He is about 90% recovered now. He still has a slight speech problem. Paul is the guy who is really responsible for the building of JSC.

Gilruth didn't like administrative work like building centers and hiring people and all that stuff. He was much more interested in the program, and getting things going, and getting people working in that direction. Paul had many talents, and that was one of his real strong points—he was a good organizer. At one time, Paul was head of the fiscal office, the payroll office, because Langley used to have a unique way of dealing with engineers. They used to rotate the engineers around in various administrative jobs, to give them some breadth. They put an electrical engineer in procurement, for example, and he decided he was going to stay there. They used engineers, trained engineers, as administrators, so that they would learn the ropes.

ROBBIE: How long was each assignment?

GUY: It was probably about a year or so. Long enough to get familiar with it.

ROBBIE: When you say Paul built JSC, what do you mean?

GUY: He was the one who got the people together from various organizations to negotiate with the organizations which designed and supervised the construction of the center. He understood how many administrative people you need, how many secretaries, how many pencils and paper, what types of facilities, all the little mundane things you have to have to make an organization work.

ROBBIE: And how many buildings you need and what needs to be in each building?

GUY: Yes. He had lots of experience building up new areas of technology and getting the necessary facilities to do the work back at Langley. Whenever you wanted anything done, you picked up the phone and called Purser and he took care of it. That's the way it worked. You didn't write memorandums. You won't find anything documented. In fact, I never attended a meeting in the entire time I was over in NASA where there were minutes to the meeting documenting decisions being made. They didn't want anybody second-guessing them.

ROBBIE: Why not?

GUY: I don't know. No minutes to any meeting I ever attended. There was a record of the decisions that were made but nothing about what the pros and cons were or why the decision was made or pretty much who did this and who did that. You'll never hear that. The only reason you know that a decision was made was that they had to spend money on a contract and they had to issue a contract change and that contract change dealt with that decision.

ROBBIE: Interesting. So they never even issued memos saying what the decision was?

GUY: I don't know of any memos. Very few memos I have ever seen and I've never seen minutes to a meeting. There were copies of briefing charts but if you looked at these and tried to fathom what decision was made and why it was made you'd most probably be wrong. Paul kept some notes on what he did during this exercise in Washington. He sent me a copy. I'll give you his notes later on and I'll keep looking for more of them. Most of those notes are later in the program, about the time the agency became the Space Task Group.

End of an Era: Langley after the Space Task Group

ROBBIE: So you were not part of the Space Task Group?

GUY: No, I didn't have to be because I supported the Space Task Group while I was there at Langley until they moved down here [to JSC]. I was available to them for any of my particular specialties. They had what they called "Capsule Coordination Committees" up at McDonnell Aircraft, talking about all of the various aspects of the Mercury program, and I was one of the members of a Capsule Coordination Committee. I flew up to Saint Louis quite a lot during that time frame. Even though I was not part of the Space Task Group, I was available to them anytime they needed any expertise I had.

ROBBIE: So, after the STG got formed--

GUY: They came down here [to JSC] in '62, I guess, and I was still back at Langley. I never knew what the deal was. I had a suspicion there that they were stealing so many people from our outfit that Thompson decided he needed to keep some continuity of experience, and so he wasn't going to let Gilruth have me, even though I had worked on the program--I'm not sure. But I got a big reward out of that--I was one of the very few branch heads that had what they called an excepted position. It might be equivalent to the Senior Executive Service. Right now it would be above the GS-15 level. Not too many at that time had that position.

ROBBIE: So in other words, you got promoted at Langley?

GUY: I got promoted at Langley. I think that was for me not raising a lot of ruckus wanting to leave.

ROBBIE: Did you want to go with the Space Task Group?

GUY: I suppose I wanted to go since it was all my old cohorts. There were some good people left. The real drivers were pulled into the Space Task Group--most of the people that Gilruth picked. He knew who he wanted.

ROBBIE: What were you promoted to? What was your position?

GUY: I got Purser's old job. I became head of the High Temperature Branch. There were a lot of branch heads who didn't have the same grade I did. I had the equivalent of two or three grades higher than most branch heads.

ROBBIE: So they not only promoted you, but they raised your rank past G-15?

GUY: Yes, they raised my grade past what any Branch Head would normally have. In fact, they had many Division Chiefs that didn't have the grade I had.

ROBBIE: That gave you, along with that, top security clearance and all that kind of stuff?

GUY: No, in the space program you don't want to have security clearance.

ROBBIE: You don't?

GUY: No, there is nothing in the space organization that is classified. Some people, if they use secret Air Force technology, they have to be cleared. But the space program is in the public domain and there are absolutely no security clearances required in the space program. That way, you can't goof up. They can't prosecute you because you didn't keep all these secrets. Plus, the fact that the stuff that they called administrative secrets--they just didn't want anybody to know about the goof-ups they had. They

don't want anybody to know how they got the intelligence. They don't want to disclose their sources for fear someone might get hurt.

ROBBIE: So how did you feel when all your friends and buddies went off to the Space Task Group and you stayed at Langley?

GUY: I felt alright. I understood, pretty much, what the deal was.

ROBBIE: How long did they stay physically at Langley?

GUY: They stayed physically at Langley until '62, then they came to Houston. At least I was working with them until '62. The big problem was, as I pointed out, where I felt Floyd Thompson's big shortfall was that instead of picking the right people—he got a bunch of people on the basis of seniority, old wind tunnel people, who had no appreciation for space, had no imagination or anything else, but they'd been around for a long time--he promoted them into key positions in the organization at Langley. They just weren't the people that should have been in charge. They didn't understand anything about space. They were aerodynamics oriented, and after all, that was Langley's main mission. Gilruth's outfit, the PARD, was the outfit that was really doing all the pioneering and had all the space smarts.

ROBBIE: What was the detrimental effect of Floyd Thompson's appointing these people?

GUY: They were real hard to talk to about anything. I have a feeling if you can't pick a fight with your boss, if he's too dumb to know what you're talking about, you better get a new boss! I kind of got that feeling at times. There were things I wanted to do.

Joe Shortal, for example, was a kind of guy who wasn't really that bright, but he never interfered with anything. He never started anything, but he'd let you do what you wanted to do--he didn't help you a lot, but he didn't stop you. He was kind of passive. He was a nice person, hands off. He had his own expertise in some areas. He had come to us from another organization--typically, Langley would move people in from one outfit, depending on--a guy could be a deputy from one outfit depending on what the organization needed.

When Gilruth first started out, he had a lot of construction going on up at Wallops Island to build this range and everything else which he knew nothing about. So they took the Deputy Chief of the Construction Division and made him Deputy Chief in my outfit until that was over. Then we had some problems with another research division. We didn't feel like they understood what we were trying to do so we took the Chief of the Division and made him the Deputy in our organization. Then we were kind of weak in an area called Stability and Control and that's when Joe Shortal came over. When Gilruth got promoted Shortal became Division Chief to our division and he never left. (Note: I think that technique of reassignment is a wonderful management tool. The people involved have to understand and trust management's judgement. Floyd Thompson and I had a discussion regarding similar transfers between Headquarters and the Centers. His comment was, "That's a wonderful idea for everyone *(pause)* but <u>you,</u> and <u>me</u>, huh?)

ROBBIE: Langley's mission all this time was aeronautics?

GUY: Yes, aeronautics. Langley was a real top notch experimental aeronautical organization. Lewis started out as an aircraft engine research laboratory. It was basically a aircraft propulsion center. Ames was also an aircraft research center. The Ames people were more of the theoretical people, Langley people were more the practical people.

ROBBIE: Ok, so Langley was aeronautics, and what evolved into Marshall was launch vehicles.

GUY: Yes, but they (all the other Centers) tried to get their hands into everything. And Ames was aerodynamics, although they tried to get involved in space. They were the ones who launched the monkey into space. Then the monkey died and Gilruth said "God, I'm sure happy they didn't launch him before they launched a man!" *(laughter)* They had this satellite and this poor chimpanzee in there and he was highly upset. And they recovered him, but he died. The program manager was Charlie Wilson, also an LSU grad of our era. This was long after the first man was launched. We launched a few monkeys out of Wallops island, namely Ham and Sam.

ROBBIE: I have been dying to know about those monkeys. Did they have diapers on?

GUY: Yes, they had diapers on and they were not up that long. They wanted to launch a pig, because a pig is very much like a person, but a pig can't stand acceleration or lay on its back for long enough. So they had to launch monkeys.

ROBBIE: So, it's 1962 and they all move on down to Houston. You stayed at Langley for another 2 years and then what happened?

GUY: I decided to leave Langley and go to work in industry. I had an offer that sounded pretty good, chief engineer, stock options and all that good stuff with a medium sized solid rocket company. I was just fed up with the fact that they were trying to reorient us in another direction. We'd been doing great work. They tried to get everybody else in the space business, too. What bothered me was that I had too many activities going and not enough manpower to really make a dent in any of the activities and yet they kept on putting people in competition with me everywhere else in the organization. I wanted to divest myself of some of these things that I had and put all the people together and let them all work so we would get enough manpower.

I had facilities that would turn out information that no one even looked at. I had so many facilities--like high temperature arc jets. I had guns that would shoot bullets twenty thousand feet a second. I had rockets that would propel payloads into space. I had an experimental rocket plant. I had centrifuges going to check up on some operational problems that occurred only during the flight of solid rockets. I had high vacuum chambers for doing high vacuum research. I had electron beam accelerators to do research on the effects of space radiation on materials.

What else did I have? Oh, I had a thermal optical laboratory to take a look at thermal optical properties of materials that were necessary to find out how much heat stays in the space craft and how much gets radiated back in the various materials. I had all these things. But I didn't have nearly enough manpower to get anything worthwhile out of any of them. Then they created the same types of facilities in other organizations who also didn't have enough manpower in competition with me all over the place.

ROBBIE: How counterproductive!

GUY: They wouldn't pull it together. I would have been perfectly willing and happy just to do my thing as good as I was doing it and let them take the manpower and take the facility and get rid of it or at least get something out of it. I couldn't get anybody to listen. They couldn't comprehend.

You see, back in the old days the way you ran a wind tunnel, a wind tunnel section may have 60 or 70 people in it. The reason for that was to gather data was such a terrible problem. They had to actually

use a scale just like Fairbanks Morse Scale. It would measure the force of one of the things with dials. People had to read all that and take notes. They had manometers that would measure pressure from the mercury or colored liquid in the manometers. People would have to read the manometers. They had all these people and then people had to build the models. People had to put the models in the tunnel. You had to have people reduce the data and analyze it.

They couldn't comprehend that we needed more people to analyze the data and here it is going all to waste. Each facility I had, with its modern high speed instrumentation, could crank out much more data than one of the old wind tunnels. They made richer people poor and yet they were creating organizations to do the same thing I was doing. I decided I had enough of that. I was ready to go off and go to work out in Phoenix, I guess. A rocket company wanted me to come out there and be chief engineer. I was almost ready to take that and then they called me from JSC, where they had had a big shakeup.

Thibodaux Rejoins his Space Task Group Colleagues at JSC

GUY: The project office at JSC had everything in it--all the various disciplinary organizations. They decided instead of having everybody to work this type of operation, to have the line organizations do all the work and support the project office. They created the Engineering Directorate with all the various discipline organizations which required avionics and you had instrumentation, propulsion, and power, all sorts of materials, guidance and navigation, flight crew operations, building the space suits and life supports systems. They created a bunch of organizations out of what they had. They didn't have anybody that they felt could run the propulsion organization. It turned out that I was the second choice at NASA Headquarters but that didn't bother me. The guy who was first choice didn't come down.

ROBBIE: So they hired you to run the Propulsion Division?

GUY: Gilruth wanted to discuss it with George Mueller. Mueller didn't know me so he had to do some research to find out if I knew something before he would sign off on it.

ROBBIE: So you moved your whole family down here?

GUY: They were still in school there. They moved down here in June after school was out. I moved down here in January, the first of January.

ROBBIE: And what was here in '64?

GUY: The Center wasn't built yet. We were spread out in buildings throughout the city of Houston. My office was an old military barracks at Ellington field across from the Officer's Club. We had a few test facilities set up that were pretty decent. The Center was in the process of being built. We moved in ten months later, I guess. It took us maybe another year to get everything going because it was '65 before we really got going and got everything operational.

ROBBIE: Got the building straight and the equipment there--

GUY: We had to do a lot of work! We had a lot of trouble getting the facilities right. The people who built them left them dirty. We had to have them real clean--not clean for appearance's sake: the things that we were working with were very hazardous and they reacted to a lot of different things and you couldn't have a lot of junk left around in the pipes. The builders didn't understand the necessities for all that. So, we had to go back and clean and verify everything. We had good people, very dedicated

people. There was this bright young kid there who knew just how to get the work done. It's just too bad there isn't anybody like him over there at JSC now.

Learning from Failure, Taking Acceptable Risks, Communicating Directly: When Work Was Fun

GUY: You see, I had all sorts of failures that I learned from. People don't learn from failures anymore because they are so conservative in all the things they do. You used to see rockets plants blowing up and rockets with pieces failing all over. Some of them still blow up. I watched enough rockets spew fire out the sides and blow up that I learned why they blow up and why they don't blow up.

ROBBIE: And they don't take risks anymore?

GUY: No. The whole thing is, you have to take acceptable risks. You take the risks whether you know it or not. Sometimes you kid yourself about risk-taking. They won't learn from their experiences. For example, we have been flying that shuttle now for 16 years and they haven't learned a thing.

ROBBIE: What is there to learn that they haven't learned?

GUY: They could learn, for example, that good design matters more than bureaucratic procedure. What Max and I proposed at first was that the solid rocket would be made in one piece, not with these joints like the Challenger failed with. If you built it at a site where you could transport it to the Cape it would all be in one piece. But that wasn't allowed, because then it couldn't be put up for bids. The only company that could have built it in one piece was right next to the Cape. Anywhere else and you couldn't transport it, it would be too big. So the whole reason it was cut in half and made in two pieces was so more than one company could bid on it, because that's the bureaucratic rule.

The other thing is that the thing which causes it to steer--that's the most expensive task in a solid rocket, to make the steering right. They had molten aluminum oxide, forty percent by weight of the rocket jet's molten aluminum oxide. You had to protect it from this intense heat, between 5000 and 6000 degrees Fahrenheit . You have this pressure, 1000 psi pressure, and it has to last withstanding that with no cooling for 120 seconds or more. It had to be able to wobble and not lock up. In order to make it wobble it's got to move around, back and forth, through pressure changes and there are all sorts of terrible things that could occur that you have to make work. There is no reason why it couldn't have been designed differently--it didn't even have to be moved. They said, well what if one of the liquid rockets goes out?

What I know about that liquid rocket, if it goes out then there won't be anything else to worry about. You can forget it because most of the liquid engine modes are generally catastrophic. You shut an engine down to keep it from failing when the instrumentation tells you that its operation is out of tolerance, but you're not sure that it would fail if you kept on going. You could have designed the Shuttle without the need for a moveable solid rocket booster nozzle. There are simpler ways to control the thrust vector.

The problem is that the control people overspecify their requirements by a factor of four or five. When we proposed the program, it was to have fixed nozzles. We flew things like that at Wallops Island with no control systems at all. They worked pretty good. That would save billions of dollars in the program because you have to recover the solid rocket. The back end of that solid rocket has probably got about ten or fifteen million dollars worth of stuff in it every time. I'd get rid of all that.

ROBBIE: You made this proposal numerous times and nobody listened?

GUY: Oh, yes, no one ever listened. In fact one of the bidders there bid it that way. They had a good proposal actually, and that would saved a lot of money. There are many other things that they could have done that would have saved the program a lot of money.

ROBBIE: Back in the early days, if you had made that kind of proposal, you would have been listened to. It would have been listened to. It would have been acted on.

GUY: Oh, yes. Back in the early days I think that I'd have gotten my way. I got my way up to a certain point. Then after that, after the forming part of the program came, Gilruth retired. It's funny when you lose your power base. Mine was as a Division Chief. There were many Division Chiefs, thirty or forty division chiefs, but I was--

ROBBIE: But you were a Division Chief under Gilruth personally.

GUY: I was one of the IN guys. I was a member of the club. If you don't know you are a member of the club then you ain't. Well you see, it's like the good old boys, sort of like that. You have influence by picking up the phone. You don't write memorandums or things like that. If you want to do things you pick up the phone and get things done. For example, whenever I'd have problems, Paul was Gilruth's special assistant and I would say, "Paul, how about handling it?" "Sure, I'll take care of it." I got a guy I needed to get rid of and I needed some help getting rid of him. So I called Paul up, "I got this problem." Paul was good. Paul knew how to handle things. If he had to gather information, he'd send someone up to look at it or something.

ROBBIE: You told me that Gilruth used to go around to talk to all his employees and sit on the trash can without turning it over at each one's desk to check on how he was doing and find out what he needed.

GUY: Yes, once a week he would stop by. I used that technique over at my Division at JSC all the time. I knew everybody in my Division, and everybody knew me. That's the difference. I got along fine. I could tell you something about everybody and their families and everything in my Division. I found out I could go and talk to them in their offices much better--they felt much more comfortable than if I called them up and asked them to come and talk to me. They would all wonder, well what the hell is he going to want? So I would go to them, and sit around and listen to them. I'll tell you what I was doing--I was leaving post-hypnotic suggestions, is what I did when I went around.

ROBBIE: What do you mean, post-hypnotic suggestions?

GUY: Well, what I wanted to do was I would do to them like Gilruth did to me. When I wanted them to do something, I didn't have to tell them I wanted them to do it. I would leave a post-hypnotic suggestion. Then what they would do was they would go ahead and do it that way, maybe even thinking it was their own idea.

ROBBIE: Exactly how would you do that?

GUY: There are all sorts of techniques, some of which I am good at doing in that environment. I'm a lousy salesman. One is called "grooming" and other things, where you kind of talk all around it and then you make polite chit-chat, and then, pretty soon, you home in on what they should do--you kind of lead them down the path you want and then you kind of drop them off. *(laughs)*

This was a very effective way of managing my Division. Rather than run it from my office, I found it much easier to run it from some of the Branch Heads' offices or the individual offices. That way I got to know everybody and they got to know me. They understood I was the boss. But I was also a friend. They could talk to me about anything. They realized that whatever problems they had they could always talk to me about them. They didn't have anything they had to cover up. It worked fine.

ROBBIE: How many people were under you in that Division?

GUY: At a peak, directly under me probably 220 people directly reporting to me. Probably a few thousand contractors, including support for our facilities and working on the things I was responsible for . One time, I had 1100 people at White Sands when it was a Branch in my Division. Most people don't realize that. White Sands was once a Branch in my Division.

KEN: I didn't know it was a Branch!

GUY: It was once a Branch. If you go look at EP you'll find out there is an EP2, EP4, EP5, and EP6. There was no EP3. EP3 used to be White Sands. There is still no letter, branch letter number, in between. I did something unheard of. I divested myself of the biggest part of my empire.

KEN: How did that come about?

GUY: It came about because I had to get rid of the guy who was running it. I'll never forget. He was messing up everything. I had a big test operation out at White Sands for the big rocket engines. The guy I had was supposed to be running the place. He had two subordinates. He had them fighting each other all the time. He'd tell a story about the other behind their back. They finally caught on. One day he was talking to one of them and the guy got the other guy on the phone and said, "Listen to this." I found out about that. I said we have got to get rid of him. He said our guy would troubleshoot for us and live out there for a couple of weeks. So we came back and got rid of him. He said, "I told you I had a troubleshooter." I said, "Well I don't know why it took him two weeks to find what it took me ten minutes to find."

After I got rid of him, in order to attract someone who might be worthy of the job, it couldn't be just a Branch in my Division. It really shouldn't have been. It had a Public Affairs Office involved in New Mexico politics. It had 800 contractors working at the site. It had a Payroll Office. It was huge—1100 people. The Senator from New Mexico was interested in it. They were interested who got the contracts--it was already almost a separate Center. It didn't belong in my operation. When I got rid of the guy who I had to get rid of, then we had to prosecute the call for someone who was going to run the place. We had to find someone. We had to create the job where it would be attractive to someone, a big enough job that someone would take it.

We had trouble finding someone for it and then we--One day it was raining, Paul and I were running across to the cafeteria and it was raining and Paul looked at me and said, "Raines." I said, "It's really raining. " Paul said, "No, Raines." I said "Yes, it's raining!" He said, "Marty Raines! Do you remember Marty Raines?" I said yes. He said, "What do you think about him running White Sands?" He doesn't remember that but I remember that very well.

So the guy who we picked to run White Sands was a fellow named Marty Raines. Raines was a captain or a major. Alan Shepard flew on a Redstone--that was an army ordinance vehicle The Army Ballistic Missile Agency- ABMA had a liaison office at the Space Task Group. Raines headed that office. He went later on to run some big operations at Kwajelin during the Hydrogen Bomb Tests and

he was a colonel in the Pentagon at the time. I said, "Yes, I think he would be a pretty good guy to do that." He said, "Well let's find out where he is." So he called and located him in the Pentagon and he offered him the job. He came out and took the job. He happened to get hired because it was raining one day. He might have gotten hired another way but that's a true story!

I remember Stan White—he was one of the first astronauts' physicians, one of the few doctors who understood engineering pretty well. He was real good to talk to and he knew about engineering aspects of the human body. You could talk to him about engineering. Most doctors you can't talk to. I remember flying on an airplane one time back. I was sitting next to him and we had real rough weather. They had turned the seatbelt light on and the airplane was yawing just wildly. I had my head glued to the back of the seat. At about that time I saw the sign move. I leaned over and I said, "Sam, are my eyeballs stabilized in space?" He said, "Hell, yes." He said the sign had "apparent motion." He said, "Your eyeballs are fixed on a straight line--that's part of your equilibrium. If you ride on a bumpy road and the road is going like this *(makes up and down motion)* and you look at the horizon, the horizon doesn't move. Your eyes are fixed on that and they stabilize even though your head may be bobbing." The seat belt sign had apparent motion. The airplane wasn't bending. There were many little things like that that I talked to Sam about. He understood the engineering aspects of the human body better than most of the other people I had talked to. We had fun. That's why I retired--it quit being fun.

ROBBIE: What year did Gilruth retire?

GUY: Right after the Apollo program, I guess. Before the shuttle started. He decided he didn't want to get involved. He didn't like all the crap he had to take.

ROBBIE: And how did you and Kraft get along? Did you have any kind of personal relationship with him?

GUY: Well, we all didn't have a problem getting along, but Kraft and his other guy ruined the center for us, as far as I'm concerned.

ROBBIE: How did they ruin the center?

GUY: Well, Kraft came up from the operations part. Operations was one of the big parts. These are the people that interface with the astronauts. The flight controllers, for example--the flight controller is the guy who gets to wave the baton, but he cannot write the music and play the instrument, is the way to look at it. They were always trying to dictate policy into how all these things have to behave. They tried to tell the engineers what they have to do and all that other stuff. They would come up with a lot of wasteful ideas and it would take a long time to convince them that you shouldn't do that--spend a lot of money. He was so afraid they were going to ship flight operations to the Cape, that he totally destroyed the engineering operations. My outfit went from about a peak of two hundred guys directly under me down to less than a hundred and many were transferred to flight operations. When they got there, there was nothing for them to do.

KEN: In those early days when everything was going great, did you have any premonition that in the future it would become more bureaucratic and so forth?

GUY: Oh, yes. If you'll read that little preamble I wrote for the NACA reunion album *[see above]*, you'll see that the one thing Hugh Dryden was very astute about was that he was very concerned about the NACA becoming the NASA. That was his main concern, that he thought the whole flavor of the organization was going to change. That little article I wrote alludes to the fact that he mentioned this to

us a number of times, and to me personally. I had private conversations with him about his concern. This was back when we became NASA. We didn't start going downhill until about the seventh year. I began to sense something about the seventh year, that the agency was falling--

KEN: Now, let's see. The space agency was formed in '58, so we're talking mid-60's here?

GUY: Yes, Apollo was on its way but I could sense that things were changing. We were getting a different class of people in charge all of a sudden. I sensed a tremendous change when Mr. Webb left. He's the only guy we ever had that deserves the title of administrator, as far as I'm concerned. The rest of these people, they are all nice people perhaps, but I don't think any of them had any particular talents.

James Webb as NASA Administrator, and Thibodaux as Chairman of the Source Procurement Board

KEN: What were Webb's characteristics that lead you to say that?

GUY: He was the greatest audience I ever spoke to. The guy hung on your every word. He was the most attentive person when you made a presentation to him. If he had other things he had to do, he'd raise his hand and stop you. Then he'd go tell someone--he gave Harry Finger writer's cramp taking down notes about things he heard you say that he liked. He'd make Harry, he'd say, "You write this down. Maybe we ought to try that out here."

When he would finish, he'd tell you to go ahead. He looked you right square in the eye and he heard every word you'd say. He understood what his job was. His job was not to be technical and not to worry about the program or the agency. His job was to sell the program to Congress and the American public. He surrounded himself with people who could take care of technical details. He had Bob Seamans, I guess from MIT Engineering school, or something. He surrounded himself with some pretty talented people. He had a tremendous background. He was the Director of the Bureau of the Budget under Harry Truman--I don't know if most people understood that. He'd been the President of a university. He was Bob Kerr's Chief of staff when Kerr was in Congress. He was the Senator from Oklahoma, you see. He handled all that type of activity. He really knew how to deal with that part of the operation.

KEN: So, he was politically smart.

GUY: He was extremely politically smart as well as being smart in a lot of ways. The guy must have had a tremendous IQ. He seemed to understand what you were talking about. It wasn't like you felt like you could give him a technical snow job. I didn't get that feeling at all. He was very astute. I had a few occasions when I was pretty much left alone to speak with him on the source board I was on.

I was the senior guy from the Center on the Source Evaluation Board for the Backup LEM Ascent Rocket Engine Injector. I was Chairman of that Source Board, but they didn't send anyone else up with me. So I had to go help him make the big decision of who we were going to give the job to. That was very interesting.

KEN: Clearly, knowing what I know now, you didn't have all this advice from Procurement and--

GUY: No, no. When I was Chairman of the Source Board, I was God. I could do anything.

KEN: You came up and said here's what we did, and...

GUY: Not only that, I didn't have to report to Max. As Chairman of the Source Board I didn't report to anybody at the Center until I was ready. It was set up that way. If I didn't like anybody they assigned, I'd throw him off. I had to get rid of a few I didn't want on the Board. You followed the procedures, but if by following the procedures, it didn't look like you were doing the right thing, well what you did is you'd kind of bend them. The whole purpose of a Source Board was to get what I felt was the best deal for the United States government. It didn't matter what was the lowest bid price or anything else. It was what's going to get you there the cheapest way in the long run, not what the guy tells you is going to work.

That time I went up with Webb, that was one of the most interesting challenges. The Scout was one of the things that I'm very proud of doing--that was NASA's first in-house launch vehicle. The second project I enjoyed working on the most was Apollo. We were in real deep trouble on the ascent engine and Bell wouldn't do what they were supposed to do, and Grumman wasn't doing what they were supposed to do. We were a year from launching the Apollo, and the engine was going unstable. We were afraid it was going to burn up.

George Low, Bob Gilruth and I had flown up to Grumman in the Gulfstream. Then we flew over to Bell to talk with Bill Gisel, the president of Bell, and tried to get him to do something. We weren't getting anywhere. Coming back after a few martinis, someone asked me, "What do you think we ought to do?" I said, "We ought to get a backup." George Low said, "Well, how much is it going to cost? And how long will it take?" I said "We can do it in a year and it will cost about a million dollars a month." He said, "Go get it." Just like that. On the airplane. He said, "You go get it." He said, "How long do you think it will take you to get everything going?" I said give me a month and I'll be ready to talk to Webb.

So, I picked up the phone and I called the Presidents of all three major rocket companies, told them what I was up to, and that we were going to have a bidders' briefing down here and that we were going to have an honest bid. We were going to do everything kosher, according to regulations. That we were going to get a statement of work prepared to present to them. They were to go home, and if they wanted to bid on it, they were to be given one week to prepare the proposals. The proposals were to be no more than seventy-five pages. So I ran a major Source Board and I had a decision by the administrator in thirty days after I got off the airplane. Now, that has never been done before or since. When I told George that, he got me on Webb's schedule right away.

KEN: I hadn't heard that story!

GUY: Very few people have ever heard it and most people would never believe it. I'd gone up to Washington. I had one of these little brown square briefcases like everybody carried. It looked like a little cardboard thing. I went up to the Continental Airlines President's Club in Hobby Airport. I set the briefcase down, and I had a couple of martinis. I picked up the briefcase and got on the airplane and went to Washington. When I started to review what the hell I was going to present, none of my material was in my briefcase. *(laughter)*

Boy, was I worried. Here's all this top secret--this is really confidential information because it told all about NASA and who we were going to recommend for the job. I was really worried. God, I was on the phone trying to chase that thing down. But I wasn't the guy who was really worried! When I opened the briefcase, it had about three million dollars in cashier's checks to pay off some sort of insurance claim. *(laughter)* It's the other guy who finally chased me down. We arranged to have Continental Airlines

send someone in a taxi to pick it up, swap 'em, and carry it back and get it back to Dallas, because he was up in Dallas. That's a true story.

ROBBIE: So, what did you do at this meeting without your material?

GUY: I got the material that night, about two or three o'clock in the morning before the meeting. Let me tell you what happened. Not only did I tell Webb I chose the highest bidder and it wasn't anybody I expected to choose, but that I was going to jack him up to three times the price he bid before I was going to let him have the contract.

KEN: Because it wasn't realistic?

GUY: Because it was not realistic and if I was going to try to run that contract that way, all I would be doing is haggling about contract changes. One of the things they don't know how to do, Procurement doesn't understand, is that if you don't size the job right, if you spend all your time haggling about contract changes while he's sitting on his butt doing nothing, you are haggling over 10% of the fee for him but 90% of your money is going down the tubes while you're doing all this haggling! That goes on. That's the biggest waste of money I ever saw. That's what I told Webb. He bought it lock and stock. He said, "All right!" Old man Hoffman who ran Rocketdyne, said that's the finest contract he ever had with the United States government.

KEN: And they could do it right.

GUY: He did it right and he said "We made every cent of profit we bargained for." And I considered that part of my job, to see that if they did an honest job, they got all the profit they bargained for. Those people over there don't understand--I doubt that many of the Center people understand that.

KEN: Was that backup engine ever used?

GUY: That's the one that flew to the moon. The other one I think we could probably have made work, I'm not sure.

KEN: But you were struggling with it.

GUY: We were struggling with it and we couldn't get it right--Joe Gavin just wouldn't put the pressure on Bell. Bell had the total capability in their plant on some work they were doing for the Air Force to do what the hell we needed done, but they were not willing to do that. I'm sure they had some union pressure and various other things. We had a good astronaut working with us too--Charlie Duke was on our team.

KEN: Charlie's a great guy.

GUY: Charlie lived with us. We gave him a desk over in the Division and he sat there and he attended every meeting we had. He worked with us all the time.

KEN: Charlie was very conscientious.

GUY: Charlie I think is one of the finest of the astronauts. He's a prince of a guy. He's also still married to Dottie, too.

KEN: Are they living in San Antonio?

GUY: They are living in New Braunfels. They have a house overlooking the #1 hole on Landa Park Golf course.

KEN: Charlie and Dottie were friends of my wife and myself because we went to the same church here in Nassau Bay.

GUY: Joe Allen, my next door neighbor, is also a prince of a guy--of course he's up in Washington now.

Hiring by Talent, Not by Degree: A Better Way

GUY: The top aerodynamic scientist the NACA and NASA was a guy named Bob Jones. I don't know if you have ever heard of Bob. Bob Jones was an elevator boy in the old NACA headquarters. A high school kid. He talked to them and they found out he was right smart so they hired him and made him a damn aeronautical research scientist from a high school kid elevator boy. You don't do that these days.

I did things like that around here because Purser was here. Things that you don't do these days. I had a technician working in my test area who was smarter than most of the engineers. So we made an engineer out of him. You could do that. You could still do it if people had courage enough to do it. You hold what you call an unassembled examination. Me and Paul got together and decided he was going to be an engineer. That was the unassembled examination. They have a different classification in the civil service--600's series rather than 800's like most of the professionals did. He became one of the branch heads. He's the guy who designed the heart pump for DeBakey. Dick Bozeman's his name. He doesn't have a college degree.

KEN: I didn't know that.

GUY: He was teaching digital electronics over at San Jacinto College. It wasn't very hard to see that he was bright. So he didn't have a college degree, so what? Why go backwards if he doesn't have a piece of paper saying he's smart when you know that he is. I also told every kid out there and every technician that I had, that if you could get me a certificate from any college that you lack only one year to get your degree, that I would see that the government pays you like they pay these kids to go get their doctorates. I said that doesn't require a doctorate degree. I'd even apply it to Bachelor's degrees in my outfit. There were three of them I sent off to college for a year at full pay and they all got their degrees and then became professional people.

You don't see anybody interested in doing things like that over there any more. Personnel people--I called that the anti-personnel department that we used to run. He was more interested in sucking up to Washington than he was in taking care of the people down here at JSC. The way they treated secretaries was atrocious. Even with temporaries.

KEN: That would have bothered me.

GUY: I don't know why they put up with it. They ought to get a good union over there. Personnel and management. We had one guy who was good. He left there. He thought he was going to become an administrative head of HUD or one of the other government agencies in Washington. Do you remember Wes Hjornevik?

KEN: Yes, I remember Wes.

GUY: Wes was great. Wes was sharp as a tack. He was a real great . I judge people by how worthy an adversary they are. Somebody you can do battle with and feel comfortable after you've done it. We used to have lunch and go round and round. The reason everybody gets a frame with every certificate they get--I got those for them. I took Wes on over that. I said, "Don't send me any of those cheap pieces of paper if you ain't got enough money to buy me a frame to hang it in." I sent him a few other suggestions. He sent them back. One time he sent one of my suggestions back and he had a picture of this big ape glaring at me. It said, "All management decisions are not stupid." I turned it over on its back and I wrote, "Sorry but your program does not authorize me to order a picture frame to hang your likeness in my office." We used to have fun!

KEN: Who took Webb's place? What was the change after Webb left? --because in effect you said NASA went downhill.

GUY: Hell I don't even know or care. That's how important the guy was. All I knew was that Mr. Webb was an administrator and the rest of the people that after him--they were all political appointees. Webb didn't quit. Lyndon fired him, in fact.

ROBBIE: Why did Lyndon fire him?

GUY: Lyndon was paranoid. Lyndon was crazy. The Vietnam thing got him to where he was a raving maniac half the time. I think Webb was over there talking to him about space programs, or something, and I think Webb told him that he was going to resign after Apollo flew. He said, "Well, I will take your resignation right now," or something like that. People who were there told me about it. Gilruth said that after one of the flights, he went up to Johnson's ranch and Johnson was just a ranting and raving maniac about telling super secret things and everything else to everybody in there and stomping the floor. I didn't know him. You know, that's hearsay. The story about Webb I'm pretty sure is true. Who did follow Webb? Was it the same guy who came back twice? We had so many of them I can't remember.

KEN: Was it Paine?

GUY: Paine and the Mormon from Utah.

KEN: Fletcher.

GUY: Fletcher, he was up there twice, I believe. A guy named Frosch came in for a while.

KEN: Yes, and he was a scientist type.

GUY: I don't know what kind of scientist he was. Who else? Oh, Beggs. Beggs was a nice guy, but I never found him to have a lot of courage like Webb did. I really shouldn't say much about them as I had little or no personal contact with them. I just observed them in action or inaction. Webb was decisive. He'd back you. That's the other thing. You felt that you were talking to someone who understood what you were talking about and when a decision was made, you were going to have all the damn backing you needed. After Apollo, the space program went to hell in a hand-basket. Those who basked in the glory of the moon landing were either gone or no longer supported NASA, so I guess these guys had a tougher time than Webb.

The Bureaucracy Takes Over

Lang was good procurement officer. Whitbeck, I didn't think too much of him. The other thing that the Center did terribly is that they always tried to accommodate every situation. Whenever two people couldn't get along, they split the organization up to make each of them head of one. Did you ever notice that?

KEN: Yes.

GUY: Max couldn't even deal with that in his own organization. We had a big proliferation. If you had three outfits there, GNC, IESD, and even Comp and Data Analysis, all would be arguing about turf and everything else. Max split IESD up into two outfits because of some fact that he couldn't deal with the situation at one time. You never accommodate false things that are not good. Trying to accommodate people is no good. In the seventeen years I headed up my outfit, I'm the only one who never had a single organizational change.

KEN: That's interesting. I didn't know that.

GUY: The same number of branches, the same number. When I shrunk down, I had to reduce the number of sections. Everybody worked. It was organized so functionally, that all the branches worked under the same mechanical things. There was never any transfer of responsibility between branches. They were all functional and they all worked only on the specific hardware assigned to them. There was always some interchange of ideas between branches. My outfit's the only one that worked that way. I had three branches. I had Primary Propulsion, which took care of the big engines. I had Power Generation, which took care of the fuel cells and cryos, and all other power generation systems. I had Reaction Control and Pyrotechnics which took care of reaction controls, hydraulic power and pyrotechnics and explosives. Those were the same for the entire time I was over there. I never got sucked into making false changes to accommodate. People always asked me when I was going to make a change. I said, "Whenever it gets necessary to change." It was never necessary.

The other thing that I told Robbie was I never attended a meeting in all of NASA that there were ever minutes of the meeting. I've never seen minutes to any meeting.

KEN: I think that is probably right.

ROBBIE: Is that your experience too?

KEN: That's been my experience.

ROBBIE: Why is that?

GUY: They don't want to be second guessed.

KEN: That's right. I think part of it is because who is going to write the minutes, who is going to write the interpretations?

ROBBIE: So they just don't have anybody do any of it.

KEN: Well, they end up, most meetings do end up with follow-on actions.

GUY: The contract changes authorization involved spending money, affecting the cost.

KEN: Yes, anytime you spend money you have to write it up and send the forms in.

GUY: Then the contract changes, that is the net result of the meetings we had. How anybody ever arrived at that decision, if you reviewed all the charts that were presented, you'd draw, some time, the opposite conclusion.

ROBBIE: But if you don't have any minutes then how do you remind everyone of what was agreed at the meeting?

GUY: Some people are presenters and then there were other members. Most of the people that were at those meetings are not necessary. They have no business ever being there. They are being paid.

KEN: I think what probably really happens, Robbie, was that the people who really had the power in the meetings, what to do about this meeting and so forth, get together behind a door and say what do we do now?

GUY: Yes, there are people who get involved and there are people who don't get involved in the decisions. You don't necessarily know who.

KEN: I think that what could be said is that so often within a government organization, the decision gets made quite frequently after the meeting. People have reflected and the key people get together and say, "Well all right, what are we going to do with it?" But, it's not in the open meeting where everybody is attending and watching.

GUY: I never attended any of those meetings but when I would show up, Thompson would say, "What the hell you doing over here, Thibodaux? I'd say, "I want to see what is going on at the circus today." He said, "How come you never come to a meeting? I said, "I'm at every meeting you have." He said, "No, you're not! I said, "If anybody from my Division is there, then I am there. They are going to tell me what happened. So I don't have to be there. I don't have to waste my time sitting there like all these others."

I got one other good story to tell. Apollo 8 was having trouble with the fuel cell. The radiator temperature kept cycling. No one knew what that meant. I'm sure I know what happened now, but it was never one of those things we reached a final decision on. We had the manufacturer down. Pratt and Whitney came down and we discussed everything. It came down to a little valve in there which is nothing more than like the thermostat on a car. The active element in it is bee's wax. The bees have excellent quality control--they make the same kind of wax all the time so that it behaves very consistently in its expansion characteristics.

There was a lot of talk about this valve being the cause of the problem. We had this up on the ninth floor. Von Braun was there, and George Mueller, Chuck Matthews, Gilruth, the whole schmeer. The cheapest guy in there, I don't even think there was a GS-15, maybe less than that. The guy who was making the presentation was Shelby Owens. Shelby was about maybe a 13 then. All of a sudden all these guys decided they were the engineers. They sat there haggling about how you were going to redesign this stinking little valve. Max and I were sitting there in amazement watching all these guys put their two cents in about how the valve ought to be redesigned. This goes on for two hours. We ain't getting anywhere. We broke for lunch. We came back after lunch and same damn thing goes on. They are still designing the valve. George looks over at me and he says, "Thibodaux, this is your

department. What would you do about it?" I said, "I'd find a GS 7 who knows a hell of a lot more about valve design than anybody at this table and tell him to go fix it."

That did it! They all quit designing the valve and said, "Next item." That took care of that. It wasn't the valve that was the problem. Turns out it was a zero-G problem. The condenser has these very small passages and as water begins to condense out it fills this thing out through capillary action. That acts as an impediment. You have very little delta p across it. It takes a while to build up enough pressure to blow all that water out. Then it begins to transfer heat and cycling. What it's doing is really flooding and unflooding that condenser. It had nothing to do with that little valve.

I've been retired for 17 years and what have they accomplished in the 17 years I've been retired? We've flown into a Russian space station and we launch almost all of our commercial satellites on foreign launch vehicles now. And we're buying rocket engines from foreigners. That's what we're doing now. No one can dispute that.

ROBBIE: In other words, you don't regret retiring when you did, because JSC hasn't done anything significant since then anyway.

GUY: No, nothing significant. I began to see the handwriting on the wall. They became an experiment in social and political change and lost sight of what they were supposed to do. Their bureaucracy took over--the White House staff basically controls all personnel who run NASA. The Congressional staff controls all the programs that NASA does, and the lobbyists, and everything else. It just got to be where it wasn't any fun. Most of the other people I know would say the same thing.

ROBBIE: How long were things good at Johnson Space Center? How long was it before the bureaucracy took over and you felt that you were not happy?

GUY: It was the beginning of Apollo. The shuttle program was passable but it lacked a lot of real talent. The people in charge felt they were working for industry rather than for the agency. Their decisions were based pretty much on what industry wanted--a lot more than what <u>we</u> told them to do. There are a lot of ways we could have saved us some men and a lot of money. The Air Force got involved with requirements and other big operations which they called flight operations. They got to be so ultraconservative that they put all sorts of ridiculous requirements on things. Then they won't watch what's going on and see that there are things you can change here. It changes your attitude, really. That is how you go about things. Contingencies, for example, and redundancy, and many of those things. You would have to use it even if you could prove you didn't need it and that you could simplify the system.

For example, Max and I saw that happen with the big solid rocket propellant on the shuttle. I started that back at Langley back in '58, in the era of big, big solid rockets. I got the thing going and the first thing they did was turn it over to Lewis Research Center. I never got to work on it. Then when they got to the shuttle they let Marshall run the solid rocket thing. Marshall had been anti-solid rocket their entire life. They were strictly liquid propellant people. A lot of things like that go on now, very inefficient.

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KEN: Is Max still coming?

GUY: I called Max tonight. I called him the other day and he said he would come. He'll never make it on time. He's going to put in his will that his body is supposed to be late for the funeral! *(laughter)* When we flew on the Gulfstream, Gilruth used to get so angry. He would threaten to leave Max about

almost every morning. He never got there on time. He did seem to make it on time when we were going home. He never gets anywhere on time. My wife and I went out with him here within the last year, and he picked us up on time. I think that was the first time in his life he had ever been on time. I'm the godfather to most of his kids, and I was the best man at his wedding. We were late for the wedding. I think he was late for the christenings of all of his kids.

Purser and Faget arrive, right on time. See next file.

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