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Interview conducted by Robert B. Merrifield - Staff
[interviewer's name/position]

Historian **at** MSC.
[location of interview]

Transcript and tape(s). [for inventory only: # pages 17; # tapes 1]

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

Education - 1944 - B.A. Astronautics & Engineering Virginia Polytechic Institute

Career Path - 1944-47 U.S. Navy; 1947 Langley Research Center - Seaberg Research Division; 1958 STG

Topics - Mercury operational concepts; orbits, communications, data, recovery; recovery philosophy; Navy cooperation in recovery operations; open ocean retrieval exercises; location beacons, flotation collars, hoist, cradle; helicopters; Navy-Marine coordination; Atlantic Missile Range; Air Rescue Service as contingency recovery force; 1958 Big Joe flight; 1959 recovery of spacecraft w/ Rhesus Monkey; Grissom recovery w/ flooding capsule + space suit; Close Call & Chimpanzee Ham recovery; worldwide recovery network capability - dev + testing of gliding parachutes; Apollo Applications Office; recovery control center at MSC; Recovery Operations Div; Retriever ship for recovery training; inter-Center cooperation; Grissom de-briefing; political unrest in Congo;

1392

May 16, 1968

Bob

The transcript of your interview, edited to remove extraneous material, is attached.

If you will, please read the statement and mark those sentences with brackets [ ] that you would not want alluded to in a Center history for reasons of embarrassment to an individual or the Center. As I mentioned during our recording session, this interview is to be part of the source material for the history, and it is doubtful that I will quote from it verbatim. Therefore, please don't worry about a sentence here or there which might not be as polished as would be desirable were it to receive public scrutiny.

If you want to add information feel free to do so. Just tack it on at the end of the statement, unless you prefer that it be inserted into the text.

After you return the transcript to me, I'll send you a copy for your personal file.

Thanks,

Don Merrifield
Code BM

Bob.
O.K.
R72
5-22-68

Interview with Robert F. Thompson
4/4/68

I came to work at the Langley Research Center in 1947. I had graduated from VPI in 1944, with a Bachelors Degree in Astronautics and Engineering, and I spent the next two years in the Navy. I worked at Langley in the Stability Research Division, wind tunnel testing, primarily in the broad field of stability and control. From about late 1957 to late 1958, the manned space flight activity was beginning to emerge as a field of interest. However, I did not work directly in that field at that time. After Sputnik, NASA and the Langley Space Task Group were organized. One of the fellows in our Division, Charlie Zimmerman helped form the Space Task Group. One day Charlie asked me if I were interested in joining the STG, which I replied in the affirmative. Around late November or early December 1958, I was asked to come over and talk to some of the STG personnel. I met with Chuck Matthews. He said STG was looking for someone to establish the recovery operations to support the Mercury flight program. The interview with Chuck was relatively short, as he had little feel for what it would take to support the recovery operations. In fact, his need was to have someone develop that feel. It sounded very interesting and challenging so I transferred from the Langley Research Center to the STG January 1, 1959.

The activity that I was assigned was to work with people like Chuck and Chris Kraft and Howard Kyle in the development of the Mercury

operational concepts. We gave some thought to what kind of orbits Mercury should fly, what kind of communications coverage was required for those orbits, what kind of data needed to be gathered, and what the recovery operations would entail. It was beginning to emerge at that time that the landing system would probably be a plain parachute and that a water landing would be employed. It became my responsibility to develop the recovery philosophy--that is, to evaluate the various probabilities, and develop the recovery requirements both for routine (nominal missions) and emergencies (contingencies). We had to develop recovery procedures and techniques for supporting aborts or emergencies during launch; and once the spacecraft was in orbit adequate contingency planning had to be provided for the flight, as well as the planned recovery operation at the end if it was a normal mission.

Now after the original effort to rough out such concepts in very broad terms to the point where I was able to develop a feel for it, the next step was to determine what would be needed to support the recovery operation. We also had to give some thought to the detailed procedures in locating the spacecraft, retrieving it from the open ocean, on-scene emergency procedures required in the event the spacecraft was leaking or the astronaut was incapacitated and all the aspects of contingency planning.

At the same time we were attempting to build up the STG organization to a manpower level that would allow us to begin to implement these activities, so we faced the dual task of developing a recovery operations since there was no pre-experience to draw on. We had never conducted,

from this country at least, global orbital operations, nor established procedure or format for supporting it from a recovery standpoint, because we had to first of all develop the requirements, then build an organization within the government, and then develop external support organization. The early part of 1959 was spent developing the philosophy and scoping the problems, beginning to build an organization within NASA, and external support.

In 1959 I made a visit to Washington and talked to Navy Department personnel in the Office of the Chief of Naval Operations, essentially to ask the Navy to agree to support the project in principle without knowing specific details. The C&O people agreed. Our reason for going to the Navy first was we recognized we had a broad open ocean recovery problem and the Navy had the resources to meet these needs. After talking to the people in C&O, I spent some time at the Atlantic Fleet Headquarters in Norfolk, Va., talking to the Cmdr of the Atlantic Fleet and his staff as to the support problem at the next lower level. We talked about various types of ships, various types of airplanes, the areas that would need to be covered, communication problems, accidents, and things of this nature. One of the first things that we attempted to scope was what type of ship and airplanes would be capable of providing the support required. We were also interested in evaluating helicopters. One of the questions that we discussed was whether or not we thought a destroyer could accomplish a retrieval of the Mercury spacecraft from the ocean. The reason for considering destroyers was primarily numerical in that they were the most numerous ship the Navy had. Also the destroyer

is a high speed ship and has reasonably good communications. We expected that they would be the basic element of ships involved in the recovery force. We also discussed the advisability of using helicopters from aircraft carriers. We concluded that we would, but not until manned space flight operations began. The Atlantic Fleet Headquarters agreed to utilize Destroyer Flotilla Command No. 4 in Norfolk as a point of contact for the STG.

My next visit was to Admiral Harry Smith, Commander, Destroyer Flotilla No. 4. We discussed what would have to be developed in the way of recovery procedures and recovery techniques so that the Navy would be able to provide ships, airplanes, communication circuits and other things of that type. One of the first things we did was to go out to sea with a destroyer and a boilerplate spacecraft and go through open ocean retrieval exercises just to see the handling problems that we might encounter. We tried several different techniques for hooking onto the spacecraft, and lifting it onto the ship. Different destroyers were used on different days. It was important to develop techniques where essentially any routine Naval ship with a minimum of equipment and training could accomplish a recovery, and then return to its normal defense function. We avoided putting a lot of highly specialized equipment on the ships or highly specialized training for the crew. To achieve flexibility, we worked with different ships on different days. This concept turned out to be a very good one in that we were then and still are able to support recovery operations with ships, whose primary duty is other than recovery.

We also proved the feasibility of retrieving the spacecraft from the ocean. This program took several months in order to get enough tests and enough varied sea conditions to where we were satisfied that we knew how to do it with a destroyer and to identify the equipment that was required. It was our task within NASA to develop and supply that equipment, which we did. As we built up our organization, people undertook the design of this equipment. Such things as location beacons for the spacecraft to enable searchers to find the spacecraft. Other items would be needed for immediate on-scene assistance, such as flotation collars, and a hoist that would enable the ship to engage a lifting line to the spacecraft and hoist it onboard, and prevent it from swinging while being lowered to the deck. Again, various devices were needed for cradling the spacecraft on the deck--field handling equipment. We would use aircraft to locate the spacecraft. On many of our missions we were certain we would have tracking information which would help us locate the general area where the spacecraft went down but then we would have to go over the area with aircraft and conduct an electronic search. We wanted to avoid dependence on visual sighting--we wanted to be able to locate the spacecraft electronically. Over the years a search device had been developed which consisted of small radio beacons on the target object and homing receivers on aircraft to give asimuth indications and which could be used to home in on a spacecraft up to a range of several miles. Then when within two or three miles of the impact point, certain visual aids could be used, or just the naked eye. We used off-the-shelf

items--beacons that had been originally developed by the British to locate downed pilots. And to give us a homing capability on the spacecraft we developed some special receivers to go in our ~~NASA~~ recovery airplanes. This gave us an airborne search and location capability. In order to have rapid access in the primary area off the beach in the event of an abort during launch (at that time we had a fairly high probability of having to abort from the booster during the powered flight which meant the spacecraft would land in the vicinity of the launch pad), we wanted a helicopter to work around the launch area. Also, to have rapid access to the normal landing area, a helicopter capability would be desirable. To perform this function, we worked with Marine Air Group #26 ~~near~~ from New River, ~~Jacksonville~~, North Carolina through the Atlantic Fleet Command. We worked with them to develop techniques whereby helicopters could actually hover over the Mercury spacecraft, engage a lifting line, lift the spacecraft clear of the water, and fly it back either to the beach, to an aircraft carrier, or to another helicopter platform.

The Navy-Marine coordination activity took up most of the first half of 1959. I also visited the Atlantic Missile Range, hoping to take advantage of the experience of the Range in recovering nose cones during ballistic missile development programs. We essentially utilized the same procedures and techniques that they used. First of all we learned all we could from the Range in regard to location techniques and the types of electronic equipment carried on the aircraft and on the nose cone to help locate it. We also were very desirous of utilizing what Atlantic Missile

Range facilities were available to ~~hover in~~ cover the launch area and some of the immediate downrange abort areas. Our plan was to blend the Air Force and Navy capabilities and create a composite recovery force. This goal was subsequently accomplished, and I think accomplished quite well. We always enjoy extremely good cooperation with those services.

Also, early in 1959, I dropped by Headquarters of the Air Rescue Service in Orlando, Florida to discuss the possibility of utilizing the worldwide deployed units of the Air Rescue Service as part of the contingency recovery force in the event we had an emergency while in orbit and had to make a rapid reentry into the earth's atmosphere. We wanted to be prepared to mount essentially a global search and rescue effort. Here also we were to enjoy very good cooperation and had in fact, a worldwide recovery capability for all of our manned flights. This support has continued through Mercury and Gemini and into the Apollo program. The Commanding General of the Air Rescue Service was a General Cunningham, and some of his leading staff members were Col Ted Tatum and Col Beaudry, and Col Jernigan.

With support commitments from the Air Rescue Service, I completed my initial task and the next several months were spent working out the details of creating a cooperative support force which would be ready for the early development flight program of the Mercury program.

The first flight that we supported was Big Joe, launched from the Cape and recovered 1800 nautical miles downrange. This flight occurred around September 1959. The recovery force for this mission was

made up of about 5 or 6 destroyers distributed along the flight path downrange, NAVY P-2 airplanes were airborne in the planned recovery area, and Air Force planes were airborne in the launch area. It was a night time launch and we had carefully briefed and trained the recovery forces in both electronic location techniques and in visual sighting techniques. As it turned out, the Atlas launch vehicle did not stage during launch. Two out-board engines actually hung up and remained with the launch vehicle rather than dropping clear as was normal which caused the vehicle to be heavier through the flight, the velocity to be lower, and hence the spacecraft subsequently landed some 500 miles short of its target landing point. In addition, there was an interruption of tracking data at the Cape, and some confusion, I guess, relative to the computer predicted landing point. From the down ~~landing~~ range recovery command post (I was down range with the recovery forces), we began to inquire back up along the line of recovery ships ~~range~~ for location information based on ship sightings. We determined that the spacecraft splashed about 500 miles uprange. We established that location as a search area and set a P-2V aircraft to search the area. He quickly located the spacecraft in the water, and the nearest destroyer, which I believe was the "Strong" as I recall it now, retrieved the spacecraft, and brought it into Puerto Rico, from whence it was loaded onto an Air Force aircraft for transport back to the Cape. That was the first prototype Mercury spacecraft flight. It was primarily a test of the heat shield, and the test did validate the heat protection mechanism. It also served to validate our recovery techniques in that we were able to react to an off-nominal situation and convert that into an essentially routine recovery operation.

In the meantime we supported recovery activities at Wallops Island where the escape system was being tested on some of the early high altitude abort flights. We retrieved those spacecraft either with helicopters from the beach, or with destroyers, depending on the type of flight. One of the milestones in this series of tests was the recovery of a Mercury spacecraft with a Rhesus monkey aboard, down off Cape Hattera during December 1959. On this occasion we made a recovery by destroyer in a very rough sea condition. Again, it tended to validate our equipment and techniques, and gave us a lot of confidence that we could effectively locate and recover the spacecraft from the broad ocean environment.

During 1960, we supported Al Shepard's flight and recovered his spacecraft by helicopter. It was only in the water for about 10 minutes. The technique we used there was to move the helicopter in over the spacecraft as soon as possible after splashdown, cut an HF antenna, engage a lifting hook, take a strain on the spacecraft, lift the astronaut into the helicopter by personnel hoist, lift the spacecraft clear of the water, and take it back to deck of the carrier. The reason we used that particular technique was to retrieve the spacecraft from the water and return the astronaut to the carrier as rapidly as possible. On Grissom's flight we attempted to use the same technique but there was an inadvertent opening of the hatch of the spacecraft before the spacecraft could be lifted clear of the water which caused the spacecraft to flood. This occurred about the time the helicopter was hooking the lifting line onto the spacecraft. Grissom egressed into the water and although he was only in the water a little more than 2 minutes, he was in a precarious position, as his pressure suit which normally would have

kept him afloat, was taking on water. Apparently a hose fitting to the environmental control system had not closed and sealed on the suit, and his suit was taking in water. He was actually beginning to have an extreme difficulty staying afloat. We had two helicopters in the area just for this kind of an emergency, by the time the first helicopter hooked onto the spacecraft and moved clear, and the second one moved in to pick Gus out of the water, he had several anxious moments. He was sputtering but hale and hardy. Subsequently the first helicopter had to jettison the Mercury spacecraft because it was full of water and too heavy for the helicopter. That has been the only spacecraft we have lost in our operations to date.

At that time an auxiliary flotation collar was under development by personnel at the Pensecola Naval Air Station. Don ~~Stulkin~~ who now works in Recovery Operations ~~participated in~~ the development of that flotation collar. After Grissom's flight we always put the auxiliary flotation device on the spacecraft, as soon as possible prior to attempting to retrieve the crew or the hardware.

Grissom's flight was followed by a couple of unmanned flights - one being the orbital mission of the Chimpanzee Ham. The recovery of Ham was touch and go. We had added an extendable heat shield to the spacecraft on this mission and on landing the wave action generated a suction force on the heat shield, it ~~began to break~~ away, and the spacecraft ~~began to leak.~~ It was floating on its side and flooding. To compound the problem, the spacecraft had overflown the landing area by about 140 miles because of a booster shutdown anomaly which in turn caused the escape tower to fire and pull the spacecraft into a higher trajectory and a splashdown

point further downrange. By the time we got on the scene with the helicopter recovery forces the spacecraft was about half submerged. We were able to engage a lifting line, lift the spacecraft clear of the water, and fly it back to the deck of the recovery ship. Ham was in good shape because the water that had leaked into the spacecraft had not gotten up to his level. ~~Of course,~~ By the time Glenn was ready to fly in 1961, the recovery force activity was pretty well matured and we were able to mount essentially a global recovery operation. We were prepared for early aborts near the pad, aborts during powered flight, any contingencies while in orbit, and routine landings at the end of the mission. The Navy and Air Rescue Service had worked with us for several months to plan the overall recovery operations on a worldwide basis. Later in the Mercury Program we moved out into the Pacific and utilized support from the Air Force and Navy Command in the Pacific. Working through the Pacific Navy command, the Australians provided recovery support assistance to us in our earlier earth orbital program. They kept airplanes both on the East and West Coast of Australia on stand-by basis in case an emergency developed during that portion of the flight.

The destroyer flotilla command in Norfolk generally changed commanders every 12 months. During the Mercury and Gemini programs we worked with some six or eight different Admirals in that command. Admirals Knowles, Hillis, Chen, Boeing, and others. These people were all instrumental in helping plan, develop, and operate recovery activity.

After we began orbital flights, Recovery Operations Center moved into the Mercury Control Center at the Cape. Key recovery people within NASA in those early years were Don Cheatham, Pete Armitage, Milton Windler, and Don ~~Stulkins~~ STULLKEN among others. Now the MSC recovery group consists of roughly 100 people. However, during the conduct of a recovery operation (as for example on Mercury) the recovery force usually consisted of 10,000 people, 15 to 20 ships, and 30 to 40 airplanes distributed around the world. There were 4 or 5 contingency recovery stations in Africa, a couple in Australia, 2 or 3 in the South Pacific Islands, and others in North and South America. We now have units so located that we are capable of responding to any emergency on a worldwide basis.

We also undertook a number of what I would call inhouse development programs, where we would develop procedures for accomplishing and supporting say landing a spacecraft on land, ~~help~~ through development programs and support of our Engineering and Development Directorate within the MSC we would test different types of gliding parachutes and develop all of the procedures.

After coming to Houston, the Division participated in the development and testing of gliding parachutes. These are to be utilized ultimately in retrieving the spacecraft by landing on land. Testing on these parachutes was carried out at Fort Hood. Some of the key people in this activity have been Pete Armitage, Milton Windler, Wayne Koons and Fred John Zarcaro, Max Faget, John Kiker, and K. Hinson. I think we have been able to show that the gliding parachute is a promising technique for spacecraft recovery in the future.

There were 2 or 3 Gemini flights remaining after I left Recovery and moved into the Apollo Applications Office. The main task ~~here~~ within the Apollo Applications Program Office is to develop this Center's contribution to the immediate post-Apollo manned space flight activity by utilizing to a large extent the facilities and the hardware developed in the Apollo program. We are attempting to increase the duration of manned space flight, and to support the Sciences and Applications ~~Directorate~~ programs in astronomy, earth resources, or basic scientific experiments in the space environment. We are planning to put man into orbit around the earth in a larger and more habitable environment than we have been able to provide in past programs, and while Apollo hardware is basically relied on for the accomplishment of that objective, it requires some modification for our long duration earth orbital objective. The last two years we have spent primarily in formulating advance plans and in setting up a project office in the Center capable of implementing that program.

As we shifted from the Mercury to the Gemini program, it was necessary that we modify some of the detailed approaches to recovery. In particular, we had to adapt our techniques and equipment to the differences between the two spacecraft. For example, Gemini used ejection seats on early aborts as opposed to the Mercury system where we pulled the entire spacecraft clear of the launch vehicle. This required a change in the disposition of recovery forces and in the type equipment, training and techniques we employed but the broad philosophy and the generalized approach to recovery, essentially remained the same in Gemini as for the Mercury program. In fact, the fundamental approach

to recovery is the same in Apollo as it was in the early Mercury days. We have reduced the number of recovery forces required to support a particular kind of mission as our confidence in the spacecraft and launch vehicle increased, however this reduction has been less than might be expected, as missions have become longer in duration and more complex. We have also gradually changed the composition of recovery units to meet the more complex needs of advanced programs, although we have continued to operate on the basic philosophy that regular DOD operational units will furnish routine recovery support--the ships, airplanes, helicopters and other vehicles that are available within the basic DOD inventory and the personnel who operate them. As the Air Rescue Service modernizes its aircraft, we develop new equipment, new procedures, and new techniques to take advantage of those changes. When we first started working with the Air Rescue Service in the early 60's, it used C-54 land-based aircraft and some Grumman SA-16 amphibian aircraft. Most of the C-54's were replaced with C-97's and we adapter our procedures and techniques to utilize those aircraft. Then a few years later, the Air Rescue Service began to receive C-130 aircraft, and we updated our electronic homing devices and other equipment.

Although we depend on DOD to provide ships, airplanes, worldwide communications, as well as people in staging bases for recovery operations, here at MSC we have developed certain unique facilities. The most important of these is the recovery control center. It was located at Cape Kennedy as part of the original Mercury Mission Control Center and when we shifted the MCC to Houston, this function moved here as well.

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Also when we began our development program for recovery equipment such as flotation collars, and new techniques for egress from the spacecraft on the open ocean, as well as the development testing of the spacecraft during the post landing environment--all became the responsibility of the Recovery Operations Division. Since DOD ships were not readily available in the Houston area, it was necessary for us to obtain a vessel of sufficient size to take the Apollo spacecraft into the Gulf of Mexico for tests. We looked at various types of ships that could fulfill this function, and we finally decided that the flat bottomed LCU (Landing craft utility) was the type of vessel we needed. So the "Retriever" became a part of the NASA-MSC inventory. We got the ship on bailment from the Army, and it's berthed in the Seabrook area. We have equipped this ship to support our open ocean work and it was used in some of the very early testing that was done of the Gemini spacecraft. Jim Lovell and Al Bean crewed a Gemini boilerplate for an 18-hour open sea test. Aside from discomfort and some seasickness from bobbing around in that small spacecraft, they came through the 18-hour test in good shape and by this means we were able to validate the postlanding environment support capability of the Gemini spacecraft. Similar tests for the Apollo spacecraft are currently underway. Both of those tests have utilized the Retriever. Other Recovery Division facilities are at what I would call the detail level like the electronic equipment that goes into the aircraft, special ship-board handling equipment like the special winch we developed that could be mounted on a destroyer in about 2 hours and has the capability of picking up an Apollo spacecraft weighing about 10,000 pounds and putting it on the deck of the destroyer. On Mercury

we were able to lift the spacecraft out of the water using ~~the~~ AN existing davit, ~~crane.~~ But for Gemini and Apollo we developed a special davit crane and that hardware was developed here in Houston and supplied to the DOD.

One of the unique aspects of the Apollo Applications Program is that for the first time more than one field center is involved in the development of spacecraft hardware. In the Apollo program, MSFC was responsible for the launch vehicle and this Center was responsible for the spacecraft. But the timing and the distribution of workload are such that MSFC has become very active in the spacecraft development. Having a Center other than MSC involved in the spacecraft development, will require closer working relationships and cooperation between the Centers.

During Grissom's Mercury flight, I was in the recovery control center at the Cape. We had a Navy S-2F aircraft on standby on the skid strip at the Cape. Our plans were to bring Grissom ashore at Grand Turk which is a Carribean Island 100 miles or so off the coast of Florida. In order to get an early reading on what had happened out in the recovery area, I left the Recovery Control Center shortly after the recovery had been completed, boarded the aircraft and flew to Grand Turk. We landed just as the helicopter bringing Grissom from the recovery ship landed. We walked into the post flight examination area there with Gus while they began to ~~re~~peel off his flight suit and pour the water out of his boots. We spent some time debriefing him on what had happened in the

landing area in an attempt to find out why the spacecraft hatch had ~~blown~~ opened prematurely off, and what changes we might want to make in our recovery procedures as a result. We learned also at that time that the environmental attachment support on the suit had not been securely closed so it was actually taking on water at a fairly rapid rate while he was in the water.

During the early days while we were developing our system of distribution of worlwide recovery forces, I stopped off in Africa. I was with an Air Force group setting up contingency recovery bases and locating aircraft which could be used in the event we had a remote area landing. We landed in Leopoldville to refuel at the height of the trouble surrounding the uprising in the Congo. The United Nations had moved troops into Leopoldville, and it was touch and go as to whether the United Nations troops were going to have to fight the Congolese Army. While we were waiting to refuel we walked over to the airport terminal. Standing on either side of the front door were armed troops. On the left was a Congolese soldier with a rifle and on the right a United Nations soldier with a rifle. We hadn't read a newspaper for a few days and didn't know whether they were friendly or unfriendly. We finally decided to take a chance and walked between them into the terminal. The terminal had been converted to a barracks for the United Nations troops and had been completely stripped of all of the civilian flight functions. Despite the tension, we had no difficulty. We refueled, reprovisioned, and left for Rhodesia with nothing more than a recollection of a potentially explosive situation.