

# ORAL HISTORY TRANSCRIPT

M. SCOTT CARPENTER  
INTERVIEWED BY MICHELLE KELLY  
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[This oral history with Scott Carpenter was conducted at the Sonny Carter Neutral Buoyancy Laboratory at Ellington Field, Houston, Texas on March 30, 1998. This oral history was conducted by Michelle Kelly and Jennifer Buchli for the Johnson Space Center Oral History Project.]

KELLY: The first question I wanted to ask you is, how did you actually become an astronaut, and what made you decide to want to be one?

CARPENTER: ... President [Dwight D.] Eisenhower decided, along with the powers that existed at that time in the Soviet Union, that in our ICBM [Intercontinental Ballistic Missile] technology lay the promise of artificial satellites and eventually manned artificial satellites. [Brief interruption] President Eisenhower made a decision that we should try to do this because it was so important ... [to our] international prestige ... that we be preeminent in space... [H]e decided we should try to do that [put men in space] and that we should take these spacemen from the ranks of jet-qualified military test pilots. I happened to be one of those. He also said that these people should have a degree in aeronautical engineering or related science. I happened to have that, and I was just in the right spot at the right time.

The Soviets did the same thing, but they didn't take test pilots; they took parachutists because they [Soviet spacecraft] came down on their own parachutes. But in any event, that's how it was decreed that I would be considered. I was ordered to Washington under secret orders, briefed on the project and asked if I wanted to volunteer. ... as you know, flying a

spacecraft, ... is a normal extension of test flying. It is your job in that business to fly airplanes that go higher and faster, and this was a quantum leap in those directions. So that's how it happened. I didn't always want to be a spaceman when I was a boy, because there was no such thing.

KELLY: You're truly one of the pioneers.

CARPENTER: It came out that way.

KELLY: Can I ask you a little bit about the selection and the astronauts, I guess the tests that they went through? Can you tell me a little bit about those and your times?

CARPENTER: Yes. The selection was not viewed by the public in its true light. A lot of people thought it was painful and very hard. And it was not. There was some hard work. That was the centrifuge. But the rest was simple, made simple by the fact that all of those tests were so much fun. They really were, and we learned about our own capabilities. We learned a lot about the capabilities of the human body in general. We faced a lot of unknowns in those days that are no longer unknowns, but that made it even more interesting because outside of the fact that we were competing with the Soviet Union, which was the driving force in the earlier days, we were also satisfying a compelling curiosity about near-Earth space and about the human organism and the human intellect as well: Can we design a machine that will do this, and can we stand the ride? It was a fascinating time, because, mainly, we were making so many unknowns known.

KELLY: What were some of the most memorable tests that you had gone through, whether they were funny or difficult or challenging?

CARPENTER: Well, the centrifuge is always fun, but hard work. We did all kinds of treadmill walking and running to exhaustion. We rode bicycles to exhaustion, but we disproved a lot of theory about human limits and endurance. The anechoic chamber was fun. That's the place where you are isolated, can't hear a thing, can't see a thing. You go in not knowing how long you'll be in there. Some people told you to expect being in this environment for two or three days. It turned out to be an hour or something. So that was fun.

What else? There are so many fun experiences, we'd never get on to space flight if we went into all of those. But they were all fascinating experiments trying to find out if the human organism had some weak spot that would make him, make the organism, unable to withstand space flight. And they tried hard to find one, but there weren't any.

KELLY: To your knowledge, were there other scientists or even physicians who were looking into that data on those tests, to see the limits?

CARPENTER: Oh, you mean now?

KELLY: Yes. Are you aware of them?

CARPENTER: Oh, sure. Limits, human limits, are still being explored, and we're doing that today in terms of long-duration space flight, because that's one thing we still haven't proved: can we stand weightlessness for the duration of a Mars flight. And I often thought in the early days that, ... these people ... [were] being very undemocratic about the tests and the suspicions they had of us because we're being considered guilty of ... being [un]able to withstand space flight, instead of being considered innocent ... [at the outset]. We showed them we ... [could] do it, you know.

KELLY: From what I understand, you broke a few ... [records] yourself.

CARPENTER: Oh, yes, but that's not important. And those tests, they revealed a lot of physical capabilities not really important to space flight, but they do ... properly demonstrate perseverance. And, you know, you can do anything if you persevere. And where I did well, it was only because of perseverance, and there's a lot of things in space flight that require ... [perseverance].

KELLY: You're very modest.

CARPENTER: Well, that's as it should be. We were very, very lucky people.

KELLY: I know that you, I think, were in the class with "Deke" [Donald K.] Slayton when you were actually going through the tests at the Lovelace Clinic.

CARPENTER: ... [we were together at Wright-Pat [Wright-Patterson Air Force Base] but I think not at Lovelace.]

KELLY: Can you tell me a little bit about him and what your personal impressions of him were?

CARPENTER: ... We [all] went through the same tests ... [he did it] like everybody else did. The one thing that was a standout about Deke was that he was a non-swimmer, and he didn't tell anybody that he went through our training with the Navy SEALs, scuba diving and all that, and he never told anybody [about] that. He couldn't even swim. His wife used to talk

about his practicing at home in the kitchen sink, inhaling through his mouth and exhaling through his nose. But that was a measure of his perseverance.

KELLY: What do you think some of the selection criteria were? Talk about what the selection was at the time and how they decided they wanted particular people to go into the Mercury Program. Do you feel that anything stood out in your mind?

CARPENTER: Anything stood out in the test program, you're saying?

KELLY: Yes, within the tests, when they decided to actually go ahead through the selection process and advance from those tests into the next round.

CARPENTER: Well, we measured the guys very well and in lots of different areas, and all had some small--all made some contribution and some indication of suitability for space flight. None of those tests revealed anybody who was not suited for space flight, but the real critical test was to be found on the centrifuge. That has direct relationship to space flight. But everybody did that okay, too. However, you have to realize that men have certain limits, and we designed the machine and the flight profile to stay within those limits. We pushed the limits, because that was necessary for a number of reasons, but the human was the [major] determinant.

KELLY: I'd like to go on and ask you a little bit about once you were selected, what was the training like then? Was it very different than what you'd gone through as far as the initial test and selection rounds?

CARPENTER: No. We continued to do a lot of work on the centrifuge, because now... the flight profile was better known and being tailored to both the ballistic flight and the orbital flight. The major difference was in developing procedures and building machinery and techniques to do what we decided some time before to try to do, but now we're building the machinery to do it. And that's fascinating, too.

KELLY: And were you involved in building the machinery itself?

CARPENTER: Sure. We were involved with every phase of the construction of our spacecraft. I happened to have personal responsibility for navigation and communications. I had done that in the Navy at the [Patuxent River, Maryland, Naval Air] Test Center. I also had experience in a Navy airplane, this photographic airplane, photo recon, that had a big viewport like this, similar to what we would have in the spacecraft. So each of us brought past experience to the endeavor, along with our burning desire to see if we could do it.

KELLY: What did you do as far as tracking the communication and navigation equipment advances?

CARPENTER: Well, I followed the development of the communications system, but navigation is a misnomer. You couldn't navigate that machine. It was a bullet, and you could decide when to come down, but after you'd made that decision, you couldn't aim it. It was already aimed. So, navigation had some input to the charts we used, but not in getting from one place to another, except from launch to entry.

KELLY: How about the communications system? How were you involved there? Were you working with the McDonnell [Aircraft Corporation] plans?

CARPENTER: Yes. We worked with Collins [Radio Company]. They made our radios. We didn't have expertise in design of communications equipment, but we were apprised of all the developments, and we had editorial rights. If we didn't like what they had decided to do, we'd change it, and they never decided to do anything, really, without checking with the forces that controlled all of this at NASA.

KELLY: That's probably very good and... [interrupted]

CARPENTER: It was very well handled.

KELLY: Did anything stand out in your mind as far as your training went that was actually original or most memorable?

CARPENTER: We had a lot of fascinating simulators. You know, the simulation field started in aviation a long time ago with the Link trainer, but we really put some fine touches on the Link trainer, and we had some fascinating machines that allowed us to experience everything we would experience in flight, everything with the exception – if you couple it with work on the centrifuge, everything except [prolonged weightlessness and] the impact with the water. And that was benign, too. I'm just reminded of a device used in selection. That is a funny machine, and I wish it could be recreated. It was called "the panic box." You've heard about the panic box?

KELLY: No, I haven't. Please tell me.

CARPENTER: It's a little cubicle with a front wall and a ceiling, two walls. You sat down in a chair, and all you could see was the inside of this cubicle, and there were lights and gongs and whistles and indicators, gauges, bells, everything, control handles of every type, knobs to turn and indicators that told you if one of the instrument readings was out of proper range. You had to watch all of these instruments, and if you saw one reading improper[ly], you had to adjust the handle to get it back in the right spot.

If any reading – there were maybe thirty or forty separate readings, each with its own different control that you had to keep centered, and if one of them ... stayed out of its normal range for more than five seconds, a red light came on and flashed, and if it stayed out of its normal range for more than ten seconds, a big, loud buzzer would come on.

It really ...[was] sensory overload, because there is so much to watch and adjust, and you don't have a lot of time, and then you've got this red light and the klaxon scaring the bejesus out of you. ... I had occasion to watch a fellow, after I had done this, [it was hilarious]. It's hilarious to see a normally intelligent human being in there, going crazy. It ... [makes you look] like you're going crazy.

Anyway, you do this at normal speed for a half an hour. After you've done the box for half an hour, you get pretty familiar with which control handles which instrument. So then you're given a short rest and put back in the chair, and this time you do it again for half an hour at twice the speed. They run a tape through to upset these readings, but it comes twice as fast. So you're really busy, but you're still learning how it worked. And then you got a rest period, and you go back and try to keep ahead of it at four times the original speed. That was a real challenge, a real challenge.

KELLY: It was probably very amusing to watch someone.

CARPENTER: Yes. But that had direct application to flying, in general. It really pushed you.

KELLY: I'll bet you spent a lot of time in simulators when you were actually assigned as backup for John [H.] Glenn [Jr.]'s flight.

CARPENTER: Everybody spends a lot of time in simulators so that by the time you really fly, everything that lies ahead of you you've done hundreds of times before, And that is the most valuable training device that has every been devised, and it's used around the world now, not only for aviators, but for ship pilots and captains, tanker captains. A marvelous new science.

KELLY: Can I ask you about when they actually decided who was going to take the first flight or the first few flights? When they announced, I believe, it was Alan [B.] Shepard [Jr.], [Virgil I.] Gus Grissom, and John [H.] Glenn [Jr.] for the first flight. Now at that time – you know, it's always been wondered and discussed, did they actually know who was going first among the seven of you. And did you have any inkling whatsoever what was going on at that time, or were you pretty much left out of the loop and NASA... [interrupted]

CARPENTER: We were left out of that decision-making. The way it happened was [Dr. Robert R.] Bob Gilruth selected three guys for the first two flights, I think. Al was to get – when we all learned this, Al got the first flight, Gus got the second flight, and John, I think, was to be backup for both of them. That's all we knew. The other four of us, Deke, Wally [Walter M. Schirra, Jr.], Gordo [L. Gordon Cooper, Jr.], and I were sort of odd men out. I think that was not handled quite right, but it is unimportant. And they flew.

And then John got the first orbital flight, and, of course, everybody was disappointed that they didn't get the first flight. And Al, of course, was very pleased that he got the first flight. He had reason to be, but it turned out that--and we didn't even know that we would

make only two ballistic flights and then go into orbital flight. So it turned out that the fellow who got the third flight really had the most heroic mission of them all.

I was named backup for John, and Deke was to take the next orbital, and Wally Schirra was his backup. But early on in preparation for Deke's flight, he had that hiccup, a heart problem ... – no more significant than a hiccup, but again, we didn't know. Anyway, the decision was made since it was so early in the preparation for Deke's flight and that I had had so much experience through all of John Glenn's scrubs, that I should get Deke's flight. So that didn't please Wally very much, but that's the way it went. Wally went ahead to fly next, and Gordo came after that.

KELLY: Can I ask you a little bit about something we talked about before? During Mr. Shepard's flight, the first space flight, you actually were in an F-106 jet?

CARPENTER: Yes.

KELLY: Something like that.

CARPENTER: I think those were F-102s. Wally and I were chase pilots and in 102s, and that was because launch operations was run by [Walter C.]Walt Williams, who had had his upbringing at Edwards [Air Force Base, CA], where every new airplane, first flight, had a couple of chase planes to make sure there's somebody there watching what's going on. And so it sounded reasonable that we should have somebody chasing Al Shepard.

So Wally and I were there ... [flying circles around the pad], and I think we had radio contact with the count. When Wally comes down, you can check with him about this, but I don't remember hearing the countdown, and I don't remember seeing Al one second, because we're going this way and he's going this way. [Laughter]

KELLY: Straight up.

CARPENTER: I didn't see a thing, ... [and] I don't think Wally did either. So we didn't chase any flights after that. And it's a good custom, but it had, in the Space Age, outworn its usefulness.

KELLY: And it was just such and unknown at that time.

CARPENTER: Along with many others.

KELLY: Then when you were acting as Mr. Glenn's, Senator Glenn's, backup, can I ask you something about some of the things that you did, and did you train together?

CARPENTER: We did everything together, yes, and that went on for quite a while. We learned so much then, too. We learned so much about what we should do and so much about what we both should not do and should not have done. But that's the name of this game. Sure, we were shadows, each of the other, for a long time.

KELLY: Do you still maintain a good relationship with him?

CARPENTER: Oh, yes. Sure.

KELLY: I'd like to ask you a little bit about your flight, and I don't want to go delve into it too much, because there's so much about it that's written, and I don't want to bore you or have redundant information.

CARPENTER: It's no matter.

KELLY: I'd like to ask you, what did you do to prepare for it? Was it much of the same training?

CARPENTER: The same thing everybody else did. We designed our own flight plan, and then we put it into an operational schedule and got in the simulator and practiced, just like everybody else had done. I had spent a lot of time in the simulator doing John's plan, but then, after he flew, I got back in the simulator and did my plan. That's fun, too.

KELLY: Did you learn a lot from his mission?

CARPENTER: Well, yes. Of course. We learned a lot from each mission, but it gave us confidence in the machine and it also opened up the flight plan for some scientific pursuits that were not just experimental flight-test objectives, and that was fun, too. I was glad about that.

KELLY: You were actually probably one of the first in space, actually, to conduct scientific experiments during your mission.

CARPENTER: Well, I guess that's so, but the whole thing is, John's flight was certainly concerned with science, but it was more inside the machine than it was outside in the environment, and I was, quite frankly, more interested in where I was than I was in what got me where I was.

KELLY: Can you tell me a little bit about that, your experience on your flight?

CARPENTER: Well, we didn't know about how a lot of things would behave in zero-G, outside. We didn't know anything about the slipstream. We didn't know anything about how well we could see certain celestial phenomena, sunsets and sunrises and occlusion of the stars at the horizon. There was just an awful lot of questions that we were asking.

And I have a good curiosity, and I'm always eager to answer and ask questions. That's what this flight did. It asked a lot of questions and brought home some new truths, one of which cleared up the mystery of John Glenn's fireflies. We really didn't – just as in those days we didn't really know for sure that the moon was not made out of green cheese, expected it wasn't, but didn't know. John saw these fireflies just prior to entry and called them fireflies, and we really didn't know for sure that there weren't some sort of living, glowing critters out there. A big question mark. It turns out they were ice that had condensed and adhered to the spacecraft when you hit the side, and they'd float off. A big mystery. It seems like nothing now, but it satisfied a lot of curious folks in its time.

KELLY: So what do you think was the most important thing that you learned either personally or professionally on that flight?

CARPENTER: Personally, it's a spiritual experience for anybody with a soul, I think, and I got that. It's a religious experience for some, maybe they've got two or three souls, I don't know. So, personally, it was a cherished experience. I feel I got the chance to see the inner workings of the grand order of things. In the overall scheme of things, it proves that men can do about anything they want to if they work hard enough at it, and I knew that I could do it, and that's a good thought. And that leads, of course, to a strong suspicion that everybody else can do it if they want to.

KELLY: May I ask you a little bit about – and this is kind of a touchy question, so you don't have to answer it if you don't like to, but if you'd like to set the record straight about your landing and I know there was a lot of controversy about it, but I'd just like to ask what your opinion and your take on it is.

CARPENTER: Well, okay. There were three contributors to an overshoot. One of them was – the major one was that the spacecraft was out of alignment. It is not known how much out of alignment. It was good in pitch and roll, but yaw, I had faulty yaw indicator readings, and there's no way you can read yaw by looking at the horizon. But it had given me some trouble for half an hour or more before retrofire. So there was that misalignment which made me go too far. They were late by a second and a half or two because the gyros being not indicating properly; I had caged them and I had to set them off manually. That contributed to an overshoot, and they were under thrust, as well. All of these things made me go too far, and I managed my fuel supply badly on the second orbit over Australia. There was excessive fuel use, which scared a lot of the folks on the ground. There was enough. There was enough for the entry. A lot of people thought there would not be. And it was anybody's guess.

It was interesting to me to note that on the last part of the entry, when I was out of fuel, that very fact proved that that particular aerodynamic shape had the stability that was designed into it, so that there was reason to believe that you could make a good entry without any fuel. It's not necessary to try, but it proved the value of the design.

KELLY: [to third party] Thank you, I appreciate that. And I also understand you had some trouble with your suit, your pressure suit, as well.

CARPENTER: Yes, it overheated. That was over Australia. That was bothersome.

KELLY: And did they learn anything from that?

CARPENTER: I didn't. I don't know whether that failure was ever pinpointed.

KELLY: I'd like to ask you a little bit about your recovery. I read your flight plan from after the flight as well, and you discussed how you inflated your raft and you basically egressed from the spacecraft, and you were just on your own, biding your own time, and you mentioned you were just taking in your surroundings.

CARPENTER: Yes. I had sort of a blessing there for the hour after the flight. Everybody else had been confronted immediately with a debriefing team, and that's an occupational hazard. Nobody knew where I was, and I didn't know that. I knew where I was. [Chuckles] But I didn't know that they didn't know back on shore.

So I climbed out, I got in the life raft, and I had a quiet time to contemplate what had happened, and I treasure the recollection of that. Pretty soon – and I wasn't worried, either, because there's a SARAH [Search and Rescue and Homing] beacon that's sending out signals to a lot of people listening, and I just didn't even think about it. But pretty soon a plane turned up. It was a plane I used to fly, and I waved to it. Then another plane turned up, and there were, before I was picked up, I think, seven airplanes flying around me, and I got tired of waving at them. I didn't pay any attention to them.

I was sitting there in the raft, and I heard this calm voice say, "Hi, there." And three Navy SEALs had jumped out of one of the airplanes and swam up ... [to] me. They had a big raft [to] put around the spacecraft. So we talked a little bit, and I offered them some of my survival food. They said they weren't hungry.

KELLY: What kind of survival food was that?

CARPENTER: Well, I don't know. It was in a package that came out with the life raft, a candy bar and some other high-energy food. Then years and years and years later, I went to a meeting in [the] San Bernardino Courthouse. Some people came in, and I stood up, and, ... [said,] "Nice to meet you." This was two decades after that. This fellow shook hands and said, "We've met before." I said, "I'm sorry. I've forgotten. Where was it?" He said, "It was in the middle of the Atlantic Ocean," and he was one of the guys who had jumped out.

KELLY: That's really interesting.

CARPENTER: It was nice to see him.

KELLY: That's terrific. I guess I'd like to go on and ask you a little bit about what you did for post flight. I understand that you had to debrief the press.

CARPENTER: Wait. I don't understand.

KELLY: After your flight, you debriefed the press and you debriefed NASA. What activities did you move on to from there? Were you working still in the Mercury Program?

CARPENTER: Well, yes, but then I got – I'd been following [Jacques] Cousteau's work all along, and through all the work here in Houston and watching his films, and being a dedicated diver after my first Navy tour of duty in Hawaii, it occurred to me that Cousteau's CONSHELF [Continental Shelf] program might benefit from a lot of the technology that we were building for space flight.

So I asked Gilruth if I could go suggest a leave of absence from NASA to Cousteau to work as a NASA representative with his program. He was speaking at MIT [Massachusetts Institute of Technology]. I went up and posed this idea. I met all his divers, including Philipe [Cousteau], and we decided that it might be a good idea and there might be some good technology transferred. He said, "You don't speak the right language, after all, and we can't pay you very much, ... [but] if what you want to do is share the technology, why don't you do it with your own Navy?"

...[It was] through Cousteau that I learned of the Navy's Sealab program. Incidentally, it was the United States Navy that first postulated the techniques that Cousteau was using in CONSHELF. That's a U.S. Navy idea. And Cousteau just got on the big screen first, but the work was all done by the United States Navy.

So I went to see George Bond, who had that program, and suggested that I come as a representative of NASA and maybe get a chance to dive, and he said fine. I went back and talked to Bob Gilruth. Bob said fine.

And so that began a series of transfers back and forth between Mercury and Gemini and Sealab that ended ultimately in my leaving NASA in '67, I think, going back to the Navy for Sealab 3, which was underfunded and hurried, and we didn't have enough time. It was a great idea, but it was an abysmal failure, and we lost a life, and the Navy canceled that work from then on. A sad thing, but that happened. [Interruption - Tape Change]]

KELLY: The first thing I want to ask you, now that we're on tape again, is how you came about with the idea of proposing to NASA using underwater training as weightless training.

CARPENTER: Well, we had a lot of tasks to perform in the water outside Sealab, and the problem in the water is you don't have traction, and it's because your weight is negated by the buoyancy, by the water. You need foot rests, something that allows you to stand solidly

somewhere like you do here, and if you're in a buoyant medium like water, you can't do that. You've got to provide an artificial restraint. That was done in space flight, partly because of what we learned and planned to do things like that in the water, and it was a very good transfer of technology this time from the ocean to space.

KELLY: Going back to your first response about Sealab and working with Jacques Cousteau, what type of technology was transferred from the space technology into this area?

CARPENTER: Well, a lot of it came from the semi-closed circuit breathing devices that we used, and then the closed circuit devices. That's what we used on the moon and used for EVA [Extravehicular Activity]. There's a lot of transfer there. The same kind of underwear that keeps you warm when you're cold and cold when you're hot is worn by [deep sea] divers ... [and men] on the moon ... So there was a lot of cross-transfer.

KELLY: It seems like there is a very big difference in the pressure that you experience in space inside that gear and under water, especially if you're very deep under water, there's significant...

CARPENTER: Well, yes, except it's a different thing. A swimmer in deep water has an awful lot of water pressure on him, but he doesn't feel it. He can stand over-pressure much more easily than he can under-pressure. The space environment outside the Shuttle, for instance, is fatal. The environment outside a Sealab down to 2,000 feet is fine. We can't go much below that, not because of the pressure effects on the body, but because of the body's response to high-pressure breathing mixes – helium, nitrogen, oxygen, and hydrogen. There's some big unknown there.

KELLY: Can you tell me a little bit about your experience in Sealab and what you did?

CARPENTER: ... [Many don't realize that Sealab was not just a sealed submarine sitting on the ocean floor. It is pressurized and open to the sea so we could work outside on the ocean floor.] Every man had one one-hour dive ... sometimes two ... [W]e did engineering experiments on salvage equipment; we did marine geology experiments, marine biology, physical oceanography experiments; we did some agricultural experiments inside the lab; and a lot of human physiology. We kept people pretty busy.

KELLY: And is there still, to this day, a lot of transfer between the underwater program ... the space program?

CARPENTER: ... Space flight tells us a lot about the ocean that we didn't know before and that we couldn't really learn [before] ... The sensors we carry in orbiting spacecraft can tell us an awful lot about what's going on on the planet, on dry land, in the water column, and on the ocean floor that we can't learn any other way...

KELLY: When you returned ... to NASA after your leave of absence, did you work at all in EVA training?

CARPENTER: ... [Y]es, but it wasn't known as an EVA trainer. It was neutral buoyancy, I think we called [it]. ... [A] small tank ... led to this. It was [a] humble beginning, but it was very helpful in designing procedures and equipment for use in Apollo and on the moon and, of course, in the Shuttle Program.

KELLY: Can you tell me about the first neutral buoyancy lab?

CARPENTER: It was very small, ... but about the time it got finished, I left for Washington ... [for Sealab III] I was in it a couple of times ... but I didn't do any space flight analog experiments in it that I can remember. ... [I]t worked well, and Huntsville built a big one, too. ... [I]t turned out to be a very good idea.

KELLY: I guess so. When you see the size of this... [Brief interruption; battery change.] So what, then, did you work on after you worked on the Sealab Program and coming back and working with underwater training? I understand you worked with some LEM [Lunar Excursion Module] development at that time.

CARPENTER: Well, yes, and I worked with the Grumman [Aircraft Engineering Corporation] folks on LEM design.

KELLY: Can I ask, what did you do?

CARPENTER: Went to Grumman, talked about cockpit layout, cockpit indicators. That's where LEDs [Light-Emitting Diodes] were first brought to use. We were on the cutting edge of technology then, but we look back at it now, and it's Model Ts, so it was ancient, but fun. That's progress.

KELLY: Where did you come up with the concept of a cockpit layout for something that was totally...[interrupted]?

CARPENTER: ... [The LEM] design ... has [been] contributed to by hundreds of people, but we at NASA had editorial rights ... so to speak, because ... [we were] the user, but a lot of good thought from a lot of people went into [the] final design.

KELLY: Do you recall any of the people that you worked with?

CARPENTER: Yes. Bob Smyth was the Grumman test pilot who I had, and still have, very high regard for. Neil [A.] Armstrong and I worked a lot with the cockpit layout. [Edwin E.] "Buzz" [Aldrin, Jr.], too. A lot of people did that. It was a big team effort, and it was a great team, and the team effort was so much fun.

KELLY: And I'm assuming, then, that they had already decided to go with the LOR, or Lunar Orbital Rendezvous, decision at that time.

CARPENTER: Yes. That was decided, I think, in '62, early on, maybe '63. I'm not sure. A lot of people and a lot of compromises involved in that, too.

KELLY: And how many years did you work in that area, developing it?

CARPENTER: Well, you know, I left in '67. So from '62 on, with the exception of the time I spent with Sealab, it was ... [LEM] and ... neutral buoyancy, the tank.

KELLY: And then I believe you were also an executive assistant to Dr. Gilruth.

CARPENTER: Yes, I worked a while for Bob. I didn't care too much for that, but I still kept a finger on the pulse of space flight. But it was not long after that that I decided I would like to

continue with the underwater work. I was fascinated with that, and it's something I hadn't done. It also was something that – that's sort of a long story, but I was afraid of the deep ocean open water. I had [a] survival exercise with my crew in Hawaii, and we were out in a life raft simulating ditching at sea. We lost our radar reflector over the side, and my gunner's mate went over for it, and he got it, but he dived into that water that was, as far as I was concerned, filled with sharks, and I wouldn't do that. I realized that I had an unreasonable fear of the ocean, and I was uncomfortable with that ... [T]hat was part of the driving force that made me want to work in the ocean. I wanted to get rid of that fear. And I did that. A lot of people have done that since the sixties... [A]s a diving community, [we're not nearly as afraid] these days of sharks as we once were.

KELLY: Have you approached any in your recent dives?

CARPENTER: Oh, sure. I did that in Guam long before that, and that's where I learned to be afraid of them, but it's fear of the unknown. They're known now by most divers. If you keep your wits about you, they're not nearly as scary as we once thought they were.

KELLY: Can you tell me a little bit about your work now in the Man-In-The-Sea program?

CARPENTER: We have a school going in Key Largo. We've got a small one-atmosphere submersible. We've got a bell and a chamber and an underwater habitat and an underwater lab... It's the only place in the world where certified divers can learn how to work in the ocean, not just play. It's a fascinating, fun place.

KELLY: What types of things do you learn in working in the ocean?

CARPENTER: How to work, how to work with tools, how to make surveys, how to develop a well head, for instance. Any sort of mechanical work that can be done in the water can be done in Key Largo. It's unique in all the world.

KELLY: Do you think that has any relation to working on the Space Station, the International Space Station we're developing today?

CARPENTER: Oh, sure. You're in a weightless environment both places, so there's still some application of what is learned in ... [one] environment ... to the other.

KELLY: Do you have any examples of what specifically maybe Space Station can learn from that?

CARPENTER: Tool development. You know, you've got to have anti-torque tools to work with. That's a necessity for EVA people. It's a necessity for the diver, too, and there are more similarities that will be revealed with continual work in both places, I think.

KELLY: Is there any sort of liaison, or is there any cooperation there at all?

CARPENTER: Any what? I didn't understand.

KELLY: Is there any cooperation at all between the programs?

CARPENTER: Yes. [Although Sealab is now defunct, NASA's currently active Astronaut/Aquanaut] ... Mike Gurnhart ... [is pursuing] that. He's currently active. I am not. I don't have that sort of an association with NASA anymore, but if there is an application that

has use on the other side of the border, somebody will be there to use it. The format has been established.

KELLY: Now I'd like to ask you just in the overall sense what you thought the most challenging part of your career was, either in the Sealab area or in your space flight.

CARPENTER: Oh, gosh. Most challenging. Probably the most challenging work is designing a spacecraft that will – this is the most challenging intellectual exercise. That's a product of many fine intellects. That's a challenge. There is a challenge to be found in the water which I also cherish having met, and that is the hard work. We've had enough money and enough talent and enough time to build machines and design systems and train people to outwit space. It's what we do: we outwit it. We don't have the time or the money or the talent to do the same thing in the ocean, and also, the ocean is a much tougher adversary, and the work you do in it is not glorious like space flight is. It is cold and it is dark, and it's dirty, and it's mule-hard work. And that's the physical challenge that separates the men from the boys, and I have great respect for that.

KELLY: Who in your mind – and it can be a group of people or several people, but who in your mind has stood out in your career as being the most admirable, the most accomplished?

CARPENTER: Well, I've got two heroes in my career. One is Wernher von Braun, because his blinding genius got us to the moon. And Cousteau, he's my other hero. [John F.] Kennedy, [Jr.,] of course, was important to lunar flight, too, because it was his charisma that got the nation behind the idea, but von Braun has my vote in space and Cousteau has it in the ocean.

KELLY: What did you find most admirable about those two men?

CARPENTER: Those two men? Well, it was von Braun's intellect, but he had a charisma, too, that was marvelous. Cousteau, because of the work he did in an area that wasn't nearly as glorified as space was, but where von Braun had charisma, Cousteau had magic, and both have their value.

KELLY: An interesting perspective. What do you feel was your most successful time in your career?

CARPENTER: ... I have difficulty separating or delineating or evaluating separately the pleasure ... I feel [in retrospect] at having been a part of the space program and been a part of the underwater program and having raised a bunch of good kids. They're all important to me.

KELLY: That's terrific. Do you think that there's anything in the space program history that's missing? Do you think there are any stories that haven't been told or things that should be known that aren't yet known?

CARPENTER: There are at least a hundred thousand.

KELLY: Can you share some of them with us?

CARPENTER: I wouldn't know where to begin, but there are a lot of funny stories to tell. There are also stories of mistakes, tragedy, and despair. You know, men simply are not above error, and we've made some terrible errors, but we've made some marvelous decisions and discoveries. We've had a lot of fun doing it all, but not without some mistakes, some costly ones, but I consider myself fortunate to have been around to see it all.

KELLY: You're truly a pioneer in that respect.

CARPENTER: It's been fun.

KELLY: Can you share any stories with us?

CARPENTER: Okay. I'll tell you one about space technology transferred to the ocean. Everybody was afraid of sharks a long time ago. We had evidence of shark attack on some of our unmanned Mercury capsules that landed in the Atlantic. We had some heat shields with shark teeth embedded in them. NASA did not like the idea of losing the heroic returned spaceman to shark attack, so Houston launched a well-paid study to develop an electronic shark chaser ... Consider it a little stainless steel sphere that would be automatically ejected from the spacecraft when it hit the water. Some antennas would go out, and an on/off switch would be turned on, and the shark chaser would emit electromagnetic and sonic radiation into the water and scare all the sharks away.

We were afraid of shark attack in Sealab. We built a big shark cage. We envisioned going out of the lab and hiding inside the shark cage with a cable and chains on it to make sure there were no sharks outside before we went out to the work area. So I called Bob Gilruth and ... [asked him to send a copy of] the shark chaser to [Perry Gilbert, the Navy's consulting shark expert,] and let him evaluate it for both Sealab and NASA?" He did ... it. He sent it back [to Bob Gilruth] after two or three weeks with his evaluation letter ... [with a copy to me].

In the letter he said – and I'm paraphrasing--but he said, essentially, "Dr. Gilruth, we have evaluated your electronic shark chaser, and we find it mildly repellent to sharks in both the on and off position." [Laughter] I saw that shark chaser not too long ago. It didn't work,

and we don't, to this day, have a good shark chaser, and the Navy has been trying to find one for three centuries.

KELLY: Wow. That's interesting. I like that. Any other stories? And Paul was asking what's your favorite beer. He always wants to ask people that.

CARPENTER: Beer? A Philippine brand called San Miguel.

ROLLINS: OK, thank you. That's my stock question. I ask everybody.

KELLY: Would you like to add anything else? I appreciate your time. It's [interrupted] that you've agreed to talk with us.

CARPENTER: It's good. I guess it's going to serve a good purpose.

[End of Interview]