NASA JOHNSON SPACE CENTER ORAL HISTORY PROJECT
ORAL HISTORY TRANSCRIPT

WAYNE E. KOONS
INTERVIEWED BY REBECCA WRIGHT
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WRIGHT: Today is October 14th, 2004. This oral history is being conducted with Wayne Koons in Houston, Texas, for the NASA Johnson Space Center Oral History Project. Interviewer is Rebecca Wright, assisted by Sandra Johnson and Jennifer Ross-Nazzal.

We thank you for coming in this afternoon, and welcome back to Houston.

KOONS: Thank you.

WRIGHT: We'd like to begin today by asking you how you first became involved with Project Mercury.

KOONS: When that all started, I was a very junior co-pilot with Marine Air Group Twenty-six, specifically Squadron HMR262. The sequence, as I was told later, was that the Space Task Group [STG] was just being formed, and they had concluded that they would like to find out if they could use helicopters to get the spacecraft [and crew] out of the ocean.

They first went to the Army, and the Army said, "We could handle that much load, but we don't know to operate off [aircraft] carriers, and we hardly ever fly over water. So maybe you ought to talk to the Navy."

The Navy said, "We do all that stuff, but we don't have external cargo capability, and also we don't have the size helicopter you're talking about. We don't have [very much] lift capability because our helicopters are pretty well maxed out with antisubmarine warfare equipment."

So the third stop was the Marines, and it came to my Group Commander, who didn't know me from one of the doors. The question he asked was, to his Adjutant, "Do we have an engineer anywhere around here?" The answer came back, yes; me. And so he said, "Get him over here."

So my Squadron Commander and I found ourselves in the Group Commander's office, and I was completely baffled by what was going on. I had never heard of man in space or orbiting or—I just never had thought about it. I was busy learning to be a Fleet Marine Force pilot. So that's how we got started.

Shortly after that, we made an exploratory, get-acquainted trip to the facility at Langley Air Force Base [Virginia]. I think [NASA] was still called NACA [National Advisory Committee for Aeronautics] at that time. The transition was just taking place. We sort of talked about what was going on, got our first look at what a spacecraft would look like, talked just very generally about the weight and so forth, [and] whether we could handle it.

Then later, the Squadron Commander wisely concluded that he'd better put an aircraft commander on the job with me. So a Marine captain named Lawrence Flannagan was assigned with me to be the Mercury Project Officers for our squadron.

That early time involved a lot of experimentation. Conceptually, they said, "How will we get the helicopter engaged to the spacecraft?" I can vividly remember one of the early boilerplates. They had some hooks, three hooks, spaced 120 degrees around the cylindrical

section with the hook downward and the little keeper in there. Somebody there had made a net with a spreader bar on it that we were supposed to hook on our cargo hook and then drag this net over the top of the spacecraft.

We tried that, and it didn't hook up. So we tried it again, and it didn't hook up. The third time, it did hook up, and as we then started trying to lift, it turned out the net was not nearly strong enough, and the thing just ripped the net apart. Fortunately, it was not very high off the ground. So we concluded, what we learned from that, that was just a really brief—not really an experiment; we just tried something out. What we learned from that was that the net was a pretty awkward thing. Unless you tied it off to extra points on the helicopter, you couldn't really keep it facing the way you were going so that it would engage the hooks that they had positioned on the spacecraft. And [the net]was pretty heavy. It was going to be quite a payload penalty.

So a group of us just sat down and started kicking around ideas, and out of that informal discussion came the idea that the better configuration would be a loop on the top of the spacecraft to snag onto. In fact, there may have already been a loop on the spacecraft, because they knew that in some cases they would use ships to get the thing out of the water. So then we cooked up the idea of using a long pole with a hook on the end and somebody leaning out the door of the helicopter to engage the spacecraft, with the helicopter alongside. And that conceptually is the way we did it.

We did a lot of refining on that as time went by. We found out, for instance, that we had to have a swivel in that sling line so that the spacecraft could rotate. Some of them were just determined to rotate when we carried them through the air, and others were quite stable; they didn't rotate at all. They just hung there and rode along nicely.

We found out that the sling [which was 12 feet long] needed to be kink-proof, and for reliability, it was actually made out of a special stainless aircraft cable. There was a company somewhere in the Newport News [Virginia] area that made these things. I wasn't involved in the manufacture of them, but it was basically an endless braid. It was a four-way braid. ([A] leather worker would know exactly what that looks like.) But it was a four-way braid, and there was only one joint end-to-end of this cable, which was actually run four ways through the eye on one end and the hook on the other end.

The eye was another piece of stainless that went in the cargo hook of the [helicopter], and the hook was a special design, to be as light as possible, because the co-pilot, as it turned out, was going to be leaning out with this thing on a pole. He had the sling to hold up and the hook to hold up, and it was pretty heavy, so it took a fair amount of dexterity and physical strength to do that particular job in the retrieval. So we sort of started off in that way as a way of getting a hold of it.

WRIGHT: Did you have to make modifications to the helicopters?

KOONS: Yes, we did have to modify the helicopters. There [was] one simple modification that involved the crew chief's intercom. We modified that so that we put a toggle switch on it, so when the co-pilot was working at that station, he could just flip the toggle switch on and his mike stayed hot. That way he didn't have to use one hand to press or push [a] switch to communicate to the pilot.

The major modification I'll come to in a little while. It involved the cargo hook.

So, very early on, they abandoned the three little hooks that were spaced 120 degrees around the cylindrical section, and we got busy learning how to engage the spacecraft.

We were also studying the mission. At that time, we were told, as I remember, that the spacecraft would weigh 1,700 to 1,800 pounds. We were also given some really wide target areas. Even though the ship, the primary ship with the helicopters on it, would be at the aiming point or the intended landing point of the spacecraft, it was possible that the spacecraft could be a substantial distance away. So we began the initial process of analyzing just how much range could we develop, how far could we go with the helicopters to pick up the spacecraft.

We got some initial sets of equipment that worked reasonably well, and then NASA began to say, "… We want to do some testing. Bring [a] helicopter and come up for a day. We want to do this and do that." So we got pretty involved.

Throughout [most of] this, Larry Flanagan was the pilot and I was the co-pilot. We got involved in the beach abort series up at Wallops Island [Virginia]—made a number of trips up there because they were having just as much trouble as ever being able to get a test off exactly when they wanted to. So there were a number of times that we got there and the test had to be postponed, so we'd go back to our normal duties and then come back later.

There was one test in which the spacecraft was just sitting on a cradle on the beach, and that was our first really operational retrieval. They just used the escape rocket to pull the thing off the cradle, and it landed in the surf a little ways out. We picked it up and had it out of the water in less than a minute and set it back on the beach for them. So that was the first, I guess you would call it operational, retrieval. [For that retrieval, 1st Lt. Norm Labhart was the pilot, and I was the co-pilot.]

We continued then with the mission development. The mission planning that was given to us indicated that we might, in some cases, need to support two ships at once with the helicopters. We did quite a bit of analysis to determine how many helicopters should be used on a ship, with an eye to having a maximum reliability. The helicopters we flew were not models of reliability. They were single engine with reciprocating engines and lots and lots of mechanical gadgetry on them, not nearly as simple or reliable as modern turbine-powered helicopters. There were lots of things that could go wrong.

So we began to develop concepts of how would we deploy a small detachment. Normally, the helicopters, at least our squadron, deployed a whole squadron at a time, or maybe they'd make up a special detachment of ten or twelve helicopters for, say, a deployment to the Mediterranean for a period of time. But we eventually came to the point that we decided that three was the optimum number, because that gave us an appropriate amount of reliability. We weren't going to be particularly bothered if one of them was inoperable on the day of the mission. Two gave us plenty of in-flight backup.

Also, our planning or typical mission involved operating off of an LSD. Now, that stands for landing ship dock. The LSD—there were a number of them in the Navy at that time—was designed as an amphibious assault vehicle. It was developed, I think, during the Korean War, and there may have been some of the early models during World War II. They were twin-hull ships, not catamarans but they had twin hulls, and the bow was completely closed off; in other words, a large, open—it was called a boat deck between the two hulls and this gigantic tailgate that went down. And when they took these things to sea, they'd have the boat deck stuffed full of landing craft, and they'd close the tailgate and go. Then when they got ready to deploy troops

to assault a beach, they would lower the tailgate and literally flood the ship to lower it so that the landing craft were [afloat].

This had a number of advantages over the older-type troop deployment, where you sent the troops down the nets into the landing craft. You've seen World War II movies. A lot of people got smashed up with [the] landing craft bobbing alongside the [landing ship]. Anyway, that was the idea of the landing ship dock. You could put the troops in the boat and then put the boat in the water, literally by flooding down the ship. And you could retrieve the [boats]. In fact, in some assaults when they were used, the ship would just stay in the hull-down position, and the landing craft could come in to pick up more people or deliver wounded or whatever the job was. It made a nice, stable internal environment. So that was the ship that we were told to expect to deploy on.

The typical LSD had hangar space. If you used that boat dock space down below as a hangar, there was room to put three of our helicopters in there and keep them in position to avoid weather damage and whatnot when you were at sea for a long time.

The helicopters, then, operated off of a helo deck on the very back end of the ship, where there was actually room on most of the LSDs that we worked off of to have two helicopters up and their rotors spread at the same time. The way you had to operate was that the helicopter had its rotors folded and the tail folded, and you'd hoist it up using the cranes on the ship and set it on the deck. Then the crew people would spread the main rotors, swing the tail around [into flight position], straighten up so everything was in flight position, then roll it back onto the aft end of the deck, and you'd launch from the aft end of the deck. This could be done in about ten minutes.

So that worked out to be a convenient sequence, because some of our extreme missions might involve going as far as 110 nautical miles from the ship to a spacecraft that had missed [the aim point. We] worked out that a ten-minute interval was good, because if you launched the first helicopter and he went to the spacecraft and for some reason was unsuccessful in getting it out of the water, whatever that lack of success might be, we figured ten minutes was long enough for him to mess around and it's time for him to get out of the way and let the second guy make the retrieval. This also, the ten-minute spacing, worked out well for handling on the deck of the LSD, so we had a good working concept. We did a number of training missions with LSDs where we would actually not have a spacecraft in the water, but when we were on a trip with the LSD, we would actually crank up a training mission where we would go to the maximum range [after launching] the helicopters in that sequence.

The [spacecraft] weight was critical. As we were developing our retrieval capability, the guys at Space Task Group were developing their spacecraft, and the spacecraft kept [getting heavier]. It didn't take us long to conclude that we were going to have to strip down and really get serious about lifting the maximum amount of weight that we could handle. So whereas the helicopter normally flew with a three-man crew—pilot, co-pilot, and a crew chief down below—we figured out early on that we were going to have to dispense with the crew chief. So we flew with a pilot and a co-pilot. [We also stripped out some non-essential avionic equipment and the large life raft.]

In the typical mission, the co-pilot would be in the cockpit for the takeoff, and he would be there to help navigate, find the spacecraft. When you got to the spacecraft, he had to fold up his seat, secure his flight station, and shinny down into the cabin and do the engagement, which I'll come to later. Then after we got the spacecraft airborne and headed back toward the ship, the

co-pilot came back up to the cockpit to help the pilot with systems management or fuel management or navigation or whatever we needed to do to get back to the ship.

So we ran several of these test missions where we'd go to just [an arbitrary] point out in the ocean. We were all used to operating in formation, and it's a pretty lonesome feeling when you head off across the ocean [alone] in a single-engine airplane. That was something we all had to get used to, because at the ten-minute interval, you couldn't see the helicopter ahead of you. You could readily talk to him on the radio, but you couldn't see the guy ahead of you, nor could you see anybody behind you. So you were out there by yourself. It was good that we trained so that we got used to that.

The procedure evolved as we went along. There were some more tests off of Wallops Island. [On one test], I think it was going to be a max-q test, somebody installed the batteries backwards or got a relay backwards or something in the spacecraft. What happened, we had gone [to Wallops], and a couple of NASA guys were taking us for a walk-around where this thing was sitting. It was a Little Joe sitting on this launcher with the spacecraft on top. When we were pretty close by, they started to charge the batteries, and [as] we were standing there talking, all of a sudden the launch abort system went off and ripped the spacecraft off the top of the Little Joe and headed out toward the ocean.

It was a pretty loud noise, and we kind of recovered ourselves, and it knocked a couple of guys down because we were in the blast area when the thing went off. Larry Flanagan said, "Get in the helicopter. Let's see if we can get it." It turned out that was futile because the main parachute didn't open, and the [spacecraft] just hit the water and sank.

But the humorous thing that happened then was that as we started at a [run] down this little trail toward where the helicopter was sitting, which was maybe, I don't know, 80 yards

away or something like that, somebody let out a big yell and said, "Look out for that smoke! It's toxic!" Sure enough, this big cloud of smoke was sort of drifting toward us. So we sort of [ran a] little faster to stay out of the smoke, and one of the NASA guys fell down and landed in the ditch. A few seconds later, then, he passed us up, and he was still on his knees. He was thoroughly motivated to get out of the smoke.

WRIGHT: He took it seriously, didn't he?

KOONS: Yes.

To talk a little bit about what went on with the flight crews while they were doing the typical retrieval, I just told you about the sequence of leaving at ten-minute intervals and going to the spacecraft. Once you got close to the spacecraft and the co-pilot went [below], the retrieval was fairly difficult to fly. As you approached the spacecraft, the pilot had to look out his window in order to keep it in sight, and as you got closer to it, in order to maneuver really close to it so that the co-pilot could reach with his 12-foot pole to hook onto it, [we] had to be pretty close to it. In fact, a lot of times in training, we would bump it with the right [main] landing gear.

When you're in that position and doing that flying down close to the water, you've got several things going on that tend to confuse you. One is that the rotor wash from the helicopter whips the water into a froth around the spacecraft. Secondly, you've got the wave and swell action that's making the spacecraft heave up and down. And with your head in that position, [looking out and down from the right-hand cockpit window], as a pilot, you tend to lose your orientation.

So we had several things that we had to do. Number one, we had to rely on what was called the automatic stabilization equipment on the helicopter. It had the capability to fly as a straight, level autopilot. It couldn't do any kind of descents or anything like that. It was kind of a rudimentary autopilot. But it did have a good system for maintaining yaw control, and that turned out to be indispensable. The pilot would get thoroughly confused if he tried to maintain yaw, and he'd wind up slewing the thing around. He'd get messed up, and he'd have to raise his head and regain his orientation. So we had a standing rule that the ASE [Automatic Stabilization Equipment], it was called, had to work, and the pilot relied on that for yaw control. He'd just take his feet off the rudder panels and trust the autopilot, or ASE, to do the yaw control.

Then you literally chase the spacecraft up and down the waves, and that's [somewhat] difficult. If it's choppy, it gets to be really tricky if you're in a swell out in the ocean. So that was part of the training, as we were training aircraft commanders, to train on a day when there was a swell out in the Atlantic. We'd carry the [boilerplate] spacecraft out and dump it where there was some pretty good wave action so that the aircraft commander got a good feel for just what he was getting into, because we were [usually] training [just] off the beach, but in the open ocean you almost always have some swell. So we had to actually work pretty hard to find sea conditions off the beach where we trained to be rough enough that we felt we were getting good practice for the open-sea retrievals.

Anyway, as you were maneuvering the helicopter into position, then the co-pilot had the option to either [lie] in the hatch and just reach out with [his] arms or to stand braced in the hatch with a gunner's belt around [his] waist and the tag line secured back to the port side of the helicopter. Most of the co-pilots opted to do it that way. I did. When I was a co-pilot, I

preferred that, because it gave me a lot longer reach, and I really felt like I was in a good position to be able to maneuver that hook and snag it into the loop.

Then as soon as you got it [engaged], the pole was designed to [slip off] the hook. Then the co-pilot, at that point, would immediately start giving verbal direction to the pilot, because as soon as you moved up over the spacecraft to begin lifting, the pilot had no visual reference at all of where the spacecraft was. But he had [an] advantage at that point. He could raise his head and go back to normal reference as far as horizon and perspective. So it was a lot easier to fly as soon as you could raise your head. But at that point, the co-pilot turned his microphone on, and then he verbally directed the pilot.

The disorienting things that happened then were that, first of all, the wind waves that would be coming at you—you would have a natural tendency to want to back up so that you match the speed of the wind waves, and you had to counter that. There were some other tendencies that we encountered. One was a tendency to try to move toward the spacecraft and get out of attitude at that time. So the training was very valid.

Anyway, the co-pilot then verbally gave the pilot direction. He'd tell him when the sling was just about to come taut. Then, of course, you'd feel it. It would always happen when the spacecraft was going down on a wave that the sling would snap taut and give you a real good yank. So you were thoroughly aware that you had it then. You were starting to lift.

Then the co-pilot gave direction, and we had to simplify the verbal direction, because there was so much noise and confusion at that time. Of course, the engine was running very close to max [maximum] power and making the maximum amount of noise, so we had to simplify the verbal direction that he gave. Eventually, we came up with just four commands: "move forward," "move back," "move right," "move left," and that's all we ever said. You

didn't need anything other than that. [For example], if the pilot was moving to the left and didn't realize it and you wanted him to straighten up, you'd just say, "Move right." You don't say, "You're moving left. You need to correct that." You'd just say, "Move right," and that took care of it.

Then you'd pick the thing out of the water and head back to the ship. [When you reached the ship], the co-pilot would go down below again to help the pilot get the spacecraft on the ship and positioned [correctly].

Complicating factors that came up—there were three major complications that developed. First, at some point along the line, the guys at NASA said, "We've decided we're going to put a high-frequency antenna on this thing. It's going to [be] a 40-foot piece of very light copper wire with a helium balloon to lift it out of the top of the spacecraft." Well, 40 feet of wire, we said, "We don't want that in the rotor system."

We first said, "Are you sure you have to do that?" [So], for a period of time, it was seriously the plan that we were going to have that balloon to contend with. So we [had to decide how] to dispose of the balloon—we tried with some test balloons, to just hover and see if they wouldn't break in the rotor blast, and we concluded they wouldn't, because sometimes they'd start swirling around, and it was not a very healthy situation. It didn't look like anything we wanted to get wrapped around the tail rotor.

So we decided we'd just give the co-pilot a shotgun and let him have at it with the shotgun. So we literally set up a test for this, and we were training co-pilots. It turned out to be a complicated training exercise. We'd put a boilerplate spacecraft out in the river there close to our station where we flew from. We got some shotguns from Special Services, and they provided the ammunition. Some of the co-pilots had never fired anything but their rifle on the

range, which was part of their—you know, every Marine rifleman had done that, but they weren't familiar with shotgunning. So we had to arrange some of them to get some little practice with a shotgun.

Then the people over at the weather station had some weather balloons that had gone out of date, and they weren't going to use them to launch their little test packages, or instrument packages. So we got some balloons and a bottle of helium, and we started training co-pilots to shoot balloons. This went on for a while. We were having a good time with it. But about the time we got pretty good at [shooting the balloons] and everything, then [NASA] said, "We've replaced that helium balloon. That's not going to work." What they found out, if there was very much wind blowing, the thing would just stream out straight from the spacecraft, and it didn't have enough vertical height to do any good as an antenna.

So they abandoned that, and they put a telescoping whip antenna that was, I think, about 20 feet long in the spacecraft, very light aluminum. It had a little explosive charge in it and was telescoping like a car antenna, but it started out about a little over an inch in diameter, and the telescoping sections, it got down to where it was a quarter-inch at the top or something like that, all very lightweight. When the squib went off, or the little charge went off, the thing just instantaneously shot up 20 feet in the air. This was scheduled to happen about two minutes, or two minutes and twenty seconds, after the landing.

So now we were confronted with this 20-foot piece of aluminum that we had to deal with. That was an interesting thing. The first thing we tried were tree pruners. We were working with the NASA guys. We were at Langley when we were working on this. We tried the tree pruners, and we found out it was relatively difficult with the spacecraft whipping around in the water and the helicopter, and we had enough to do anyway, but to try to get the tree pruner hooked around

that thing and then for the co-pilot to get a hold of the rope on the pruner and pull hard enough to shear off this aluminum turned out to be a little bit too much to expect.

Somebody said, "Let's put an explosive device in that." So the next thing we had was a tree pruner where you got it hooked around, and then the co-pilot had to feel up on his handle and flip a switch to blow a little charge, which flipped the knife around and cut the antenna off, and that worked all right.

As we went further with this, though, we had two things. One was, there was no redundancy there. If he flipped his switch and happened to miss, if the spacecraft came out of the hook at the wrong time, then the antenna wouldn't get cut and he would have popped his squib and not have any way of getting rid of the antenna.

So we went to a different configuration in which we had an open fork at the end of the pole, and we had two knives on there, one here and one there [demonstrates]. Then we set it up so that we armed it. There were some microswitches at the apex of the Y so that the co-pilot could arm it. He'd just reach out and literally just stab it at the antenna, and the instant it made contact, both the knives would come around. So we had redundancy. If one of them failed, the other one would get the job done. And that worked out very well. That was the configuration, then, that we used for the rest of the missions.

Another major challenge that we were presented, all at about the same time, was when they discovered that [if] the spacecraft hit too hard, particularly if it landed on land, like in a beach abort (if it landed on the sand instead of the water), it was not going to be a survivable impact for the astronaut.

So they put a deployable landing bag, which several other people I know have described, in there. The deal was that you [separated] the heat shield at the bottom. The spherical heat

shield at the bottom was [separated] or detached, and it dropped down on a four-foot cylindrical bag, and then if the spacecraft landed on the beach, why, this four-foot bag full of air acted as a cushion. Then they had vent holes in there that were sized so that it would just go "whoof," and not bounce. We didn't really want the thing to relaunch itself in a big bounce, so it was vented, the bag was vented.

I remember Pete [Peter J.] Armitage called me and said, "We've got a real problem. We may have to give up using helicopters to do this, because the spacecraft is going to weigh over 12,000 pounds." That's about what the helicopter weighed, and, of course, 2,000 or 2,200 was about the limit of what we could handle. So he explained that we were going to have this bag full of water down there.

I remember asking, "How are you going to pick it up with a ship? You'll pull the loop right off the top of the spacecraft."

"They're still working on that."

So what we developed there was that as it was originally configured, those holes, which were about that big [demonstrates], about five or six inches in diameter, were at the top of the bag up next to the spacecraft. We said, "Just turn the bag upside down and put the holes at the bottom, and then [we] can drain the water out as [we] lift it." Now we're back in the situation where it's actually better to use the helicopter to pick it up, because if a ship—for instance, if a destroyer is lying in the trough and rolling, which is usually the way they wound up—when they get alongside, they pretty much wound up lying in the trough, lying parallel to the waves, or the swell—the line that they were using would come taut suddenly, and you stood a good chance you were just going to yank the top off the spacecraft, you were going to overstress the [loop] because of all this water trapped in there.

The helicopter had the advantage, in that it could put a fair amount of lift on, or tension on, the line, and then if the spacecraft needed to go down, it'd just pull the helicopter down with it, so the two, in a swell, would go up and down together. So that was what we worked out.

It turned out that it complicated the retrieval for the helicopters, of course, quite a bit, because [we] had to [hover] there, oh, for over two minutes at a high power setting, hovering, while the water drained out to where it was light enough that you could actually lift it and go ahead and pull it. It also complicated things because now you had this extra four-foot bag hanging on there, which made the drag higher and increased your fuel consumption and had the net effect of reducing the range we could go to make the retrieval.

Then throughout all this time we had been planning that the astronaut would just stay inside the spacecraft. We had gone to Langley one day to—and I probably don't have these things in sequence at all. I think I'm out of sequence about a year now on this, date wise. We had gone up to Langley to support some egress training. They had sort of a semi kind of a fancy boilerplate spacecraft that had been configured to allow—it had sort of a couch in it, and they used it to train the astronauts on how to get out of the spacecraft.

To start the day's work, we picked up the spacecraft and carried it over to what was called the back river at Langley, which was generally north of the area of the Air Force base. It was actually the mouth of the river and was close to the Chesapeake [Bay] there. As we were making a circuit around the airfield to head over to drop it in there, to place it in the water, all of a sudden I realized the hook had opened. I was flying aircraft commander by this time. The co-pilot said, "We just dropped it."

Fortunately, it landed on the ramp over on the west side of the air base. There were some experimental aircraft over there, which it would have been a really bad day if the thing had hit

one of those. But it seriously messed up the spacecraft when it landed on this ramp, and that caused us, then, to start a whole evaluation of how in the world did that hook open.

Of course, I felt then like Gus [Virgil I.] Grissom felt later; everybody blamed me because I was the guy at the controls. Everybody figured that I had done something to [cause the problem]. I'll take a minute to describe the hook that we used. It was called a hook. It literally wasn't. Hanging on a bridle of four cables beneath the spacecraft was this electromechanical thing which could be opened electrically or mechanically. It was closed manually by the crew chief. When you picked up a [typical] external load, the crew chief or somebody [on] the ground was on top of that load, and he put the loop of the load sling through the jaw or load beam of this hook and slammed it shut [while the helicopter hovered above the load]. That's how we got engaged to the load. We held a hover while they got it snapped on. Then this guy jumped off the load, and we picked the load up and left.

What had happened, as it turned out, we impounded that hook that had opened and dropped the egress trainer, and in the investigation, we took it—or sent it—to Eastern Rotorcraft, which was the company that made that accessory for the helicopters. That was a company up somewhere just north of Philadelphia [Pennsylvania], in the Philadelphia suburbs. They did some serious analysis of how could this have happened, and they discovered that it was possible to have a tolerance buildup—right from their shop drawings—it was possible to have a tolerance buildup so that the release mechanism was riding on dead center. Therefore, it could go either way. It could go tighter into a lock position, or it could unlock, and it unlocked.

Now, this was not a really rare occurrence. Every once in a while, a helicopter would drop an external load. But normally, that was something like a Jeep or a pallet load of beans or

whatever, and nobody got real excited about it. They said, "We're going to have to go back and get another one."

But this analysis by Eastern Rotorcraft, I think, kind of shocked them, to find out that they were turning out a product that was literally unreliable. It certainly was a wake-up call for us, because we were about to start hauling people around on something that was unreliable. So this caused a flurry of activity and eventually became an aircraft service change for the HUS. HUS was the helicopter we were flying.

The service change involved putting an internal locking mechanism in the hook. It was just a little roller on a lever, but it held the mechanism locked. In order to unlock it, the pilot's control stick had a lever on it, added a little bit below all the other things that were on the top of the stick. In order to disengage or release a load, you had to first get a hold of that and pull it—it was just a little lever—and pull it, and then you could disengage either electrically or with a mechanical backup system, which involved picking up your right leg and stomping on [a plunger] with your heel.

It was just a plunger sticking out of the floor of the cockpit, which is the way most of us opted to fly. We disengaged the electrical disconnect and went pure mechanical, because that way we didn't have to worry about static discharge or any of the other things that might cause the electrical system or an electrical pulse to malfunction and cause the hook to open. So that became—I think it was called Aircraft Service Change 180, and it was eventually installed in twenty-some helicopters in Marine Air Group Twenty-six.

Then at about that point, everybody began to conclude—you know, "Yeah, you fixed it, but I'm not sure carrying that spacecraft around with the guy still inside it is a very good idea." So we began to work on a procedure where we would, as we eventually did for the manned

mission, where we would engage the spacecraft and get the helicopter in a hover above it and start draining the water from the landing bag. But then at that point we'd sort of hesitate.

When we're talking to the astronaut on the radio, the [astronaut] then would open the hatch and slide partway out, sit on the sill of the hatch on the spacecraft, and we'd send the horse-collar sling down to him. He would get that around his shoulders, and we'd [hoist] him up and get him in the helicopter. Then we'd go ahead and complete the lift, get the water drained out of the bag and take the spacecraft back to the ship. And that's basically the way we did the [Alan B.] Shepard flight.

There were two flights, though, prior to the Shepard flight that I think are worthy to get recorded. There was a flight that had a primate aboard, and it was out into the open ocean, several hundred miles out, and the helicopters were deployed aboard the USS *Fort Mandan* or [USS] *Donner*. I can't remember which ship it was. The flight had an anomaly in which the launch abort system didn't disengage properly, and it added additional impulse, or velocity, to the spacecraft, and the spacecraft wound up—I don't know, 80 or 100 miles downrange from where it was supposed to be.

It turned out to be quite an eventful day. We left. The lead pilot for that retrieval was First Lieutenant John [A.] Hellriegel. Once [the ship] got within range and got our fuel load adjusted, John took off first and headed toward the spacecraft. I was flying number two, and I don't remember who John's co-pilot was, and I don't remember who my co-pilot was that day. Anyway, I took off ten minutes later and headed out toward the spacecraft. Then the number three plane—and I can't remember who was flying number three at all—number three was behind us.

John called when he got the spacecraft in sight and said, "Okay, we've got it in sight. We're going to go ahead and pick it up." Well, it turned out, as other people have noted, that the—I think Bob [Robert F.] Thompson particularly noted—the spacecraft had been damaged by the heat shield, which was deployed on the bag, and the heat shield had skipped on the water and come up and knocked a hole in the pressure vessel close to the primate couch, or made a hole in the pressure vessel, anyway. So when John got there, the spacecraft was on its side and obviously taking on water and laying pretty low in the water.

So they went down and got it, got hooked up to it, and the next thing that I heard from John was, he says, "We've got it, but, boy, is this thing heavy." Of course, he could tell from the way it was flying that it was real heavy. The sea conditions were like a state-three sea where he picked it up.

Of course, I was there. Within a couple of minutes, I had reached the site and joined up [in] a kind of a loose formation to follow him back to the ship. And we picked up the number three aircraft then a little bit later.

As we headed back towards the ship—of course, we were a goodly distance from the LSD—we were approaching a destroyer, one of the destroyers that had been positioned downrange. In fact, I had flown over that destroyer on the way out. As we came back, the destroyer came up on our primary UHF [Ultra High] Frequency and said, "We want you to put that spacecraft down on the fantail of the destroyer."

As it turned out, the destroyer was in an area where there was a much rougher sea. They were 20 miles or more from where the spacecraft had landed. They were taking a pretty good ride. It was probably a state-five sea where they were. So we had a number of factors involved.

First, the destroyer was in a really rough area, and the waves were breaking over the fantail. You could see the water, green water, running over the back of the ship. That was inducing the destroyer to pitch a lot. From the air, you could see the thing pitching up and down.

Another major factor was [that] we had never, ever contemplated setting that thing down on a destroyer. Another factor was that there was no preparation made. It was just a bare deck. There [were] no pads or anything there to handle the thing. They, of course, had the lifting rig. If they were going to pick it up from the water, they had that equipment on board, and I think they had some people on board who were trained to handle the spacecraft, but it looked to me like a very unsafe thing to attempt. [We also had never analyzed the clearances to see if it was possible to set the spacecraft down on the fantail without hitting obstacles on the ship, such as antennas.]

So John Hellriegel answered that first call, and he said, "I don't think that's a very good idea. I'm not sure we want to do that."

The next voice we heard on the radio—you could tell by the com sign; communication sign—was the commodore himself speaking on the radio. He said, "Hunt Club," whatever the side number was, "this is—," call sign, whatever it was, "I want you to put that thing down on the deck right now. That's an order."

So I took my career in my two little hands. I was senior to John and was technically the flight commander, or flight leader, even though I was flying number two. And I gave the commodore an answer and said, "We're unable to do that. Safety of flight, and we're heading on back to the [LSD]," or something to that effect, which probably infuriated the commodore to the point he didn't have anything more to say. We didn't hear any more from him, anyway.

As it turned out, there were more things going on. As I mentioned earlier, the LSD frequently would ballast down, it was called. They would flood voids in the ship to lay it low in the water so that the boat deck would flood to let boats in and out. So they were used to carrying seawater in some of their void tanks, or fuel alternately. As they were getting cranked up to make max speed coming to follow us so we had the minimum range to get back to them, they decided their tanks were about empty, and they switched tanks.

Now, [the fuel] was bunker oil, and for some reason—I never did understand this—they were feeding both boilers out of one tank. When they switched tanks, they were still feeding both boilers out of the tank they switched to, which turned out [to be] full of seawater. [The water] doused the fire in both boilers, and it just stopped the ship. The ship lost everything. It lost communications; it lost ventilation; it lost way through the water. They couldn't even turn the rudder. They were absolutely dead in the water with no power.

They had a good amount of seawater that they'd sprayed into their fire boxes, so things were pretty cold in there. They have an emergency generator on board that at least will run the radios so that they can communicate. They fired up the emergency generator, and it ran just a few seconds and it quit. So they were literally dead in the water. I mean, they were literally dead. They couldn't do anything.

We didn't know that. We were assuming the ship was at point so-and-so [and coming toward us]. John is reporting that he's using a lot of fuel carrying this thing, because, as it turned out, it had a lot of water in it. It was much heavier than anybody ever expected it would be, and the ship wasn't moving. So as we approached the point where we should be able to see the ship, which is normally [a range of] about eight miles, there was no ship in view.

At that point, all we could do was keep going. Finally, the first communication we got was from one of our Marine detachment on board, because part of our packup included a field radio that would net up with the tactical radios we had on the helicopters. So that was the first word we got, and they reported that the ship was dead in the water and they were trying to get power back and etc., etc.

So we reported that we had a very heavy spacecraft in a very low fuel state and said, "We [need] a little adjustment to procedure here." They had made a skid padded with mattresses. "As soon as that thing's on [the skid], you've got to haul it forward quickly and let the helicopter land directly." Normally, you would set it down and then fly off it and give them time to clear the deck so you could land. So we made it known that "If this all works, we're going to set that thing down, and you need to move that spacecraft forward quickly so that the helicopter [can] land directly."

About this point, I think we were maybe five miles from the ship, and John reported he'd gone to a red-light state on his fuel, which meant he was down to 200 pounds and had roughly 20 minutes of flight time left. You get really nervous when that red light comes on.

It all worked out. John told me he set the thing down and he said he dropped the sling, opened the hook and dropped the sling, and he said, "The next thing I knew, there was that spacecraft right out in front of me." He said, "Those guys really moved it in a hurry." So that all worked out. We got that mission done.

The unpleasant part of it was the post-mission conference, where I had to confront the commodore. I was still a first lieutenant, [and] we had a short but vigorous discussion of what had happened.

[interruption]

WRIGHT: I think you were about to tell us about your first open-ocean retrieval.

KOONS: Yes. That was the first Mercury-Atlas flight. That particular one did not have a landing bag on it. It landed somewhere way out east of Puerto Rico. That one also went long, and I don't know why it went long, but it was not anywhere close to the ship. It was 40 miles or so from the ship. In that case, it was located by the search aircraft, which were, I think, P2Vs.

We had some difficulty communicating with them. We had tested our procedure of being vectored by the search aircraft to the spacecraft, but we had never encountered this kind of difficulty, and for whatever reason, we had real difficulty communicating with them. We had been given the latitude and longitude, so we went to the spacecraft by dead reckoning. Eventually, we were actually pretty close to it when we finally got communication with the P2Vs.

My co-pilot for that was Captain Al [Allen K.] Daniel. There was a pretty severe wind and sea state when we got to that one. It was like a state-four sea. The spacecraft was really going up and down. We did not have to contend with the antennas. The whip antenna was not installed on that one.

Al got the thing snagged, and we got it out of the water and took it back to the ship. Aside from the fact that the water was really rough and it was difficult to handle from that standpoint, it was not particularly eventful, and the fact that we had to go 40 miles—I think it was about 40 miles—was not a big deal after having gone after that primate, where we went 80-some miles.

The navigation that we did probably is worth describing. When you operate off an LSD, at that time they didn't have a TACAN [Tactical Air Control and Navigation] base, which was our primary way of [navigating]. When we were at sea, we normally operated off carriers, and they had a TACAN station on the carrier, so you had a good way, of anywhere up to a couple of hundred miles out, of being able to navigate using the carrier as your reference. The LSD didn't have that, so we were without that.

The thing that we trained all the co-pilots to do was to navigate with the plot board, which was a thing about 14 inches square that had a transparent wheel inside it. You could use a grease pencil, but a lead pencil worked just fine. They all called it the "Ouija board." It was derivative of the thing we had been taught in flight school, in that you could calculate ship speed and velocity and aircraft speed and velocity, and then the critical thing was to get the right amount of wind blown in so that you made the right heading in order to get the correct ground course. All the co-pilots had to learn to do that and do it well, and we held classes right along with all the other stuff. We had ground school on how to run the plot board.

There were a number of deployments, a number of times that we went to sea, that the launch didn't get off, so we got lots of experience riding around on LSDs. For one mission, the spacecraft was going over close to the Canary Islands, and they sent an LSD with a three-helicopter detachment on it over there. Fortunately, the squadron commander decided I was needed more back on the beach, so I didn't have to take that [trip. That] was a long ride for those guys. They were gone almost a month, and they did not get to do the retrievals. It was very frustrating for the guys who had to make that trip.

WRIGHT: Could you share with us a few details about the deployments, either that one or another one, when you would go? How long would they be gone? How long would they be on the LSD?

KOONS: Gosh, that varies all over the place. Typically, when we deployed we took the three helicopters, which required six pilots to fly those. We took a spare pilot, so we had seven officers in the detachment. Then we took ten enlisted men, the crew chiefs for the three helicopters and then specialists. We had an NCO [Noncommissioned Officer] line chief kind of guy who was in charge of the enlisted people, and then we had an avionics guy and a hydraulics guy and an engine mechanic and so forth.

We carried a specialized pack of spares. As I mentioned, the automatic stabilization equipment was critical. We couldn't do the mission without it. So we carried—they were called CG&A boxes [Control Gyro and Amplifier Boxes]. It was kind of like a mechanical hydraulic fluid amplifier contraption, and it had a lot of vacuum tubes in it. All of our avionics then were vacuum tubes, so we had the normal run of relatively low reliability compared to today's avionics. Vacuum tubes just don't work like solid-state equipment. And those CG&A boxes were really rare birds. If you had one that worked on the shelf, it was rare, because they failed regularly. So we actually caused quite a problem for our squadron logistics people, because we took all the high-use spares and we'd be gone with them for a long time when we did these deployments.

The squadron was twenty-four to thirty [helicopters], so they were trying to keep all the other [helicopters] flying with the high-use spares off with us on an LSD. So it was a real

hardship on those people to keep the rest of the squadron operational. Anyway, that was the size of our deployment.

Very often the LSD would be in Norfolk [Virginia], which was a couple-hour hop from [Marine Corps Air Facility] New River [North Carolina], which was our base. We'd fly there and go aboard the day before the ship sailed, and ride. We had a standard operating practice that required that we fly at least every third day, and that was a very real requirement. [In] the engines on the helicopter, the oil would tend to drain down, and if you tried to [fly] after three days without running the [engines], the requirement was that you had to pre-oil them. You had to hook up this big ground cart and pump oil through the engine and recirculate the oil, because it would be drained down to a point that you would damage the engine if you started it without pre-oiling it. We didn't have a pre-oiler to take along, so we had to fly them every third day, minimum.

But that was probably also good because it gave the ship's crew practice in handling the helicopters, which was a real challenge for them, because it was something they didn't do very often, to move those things on the boat deck back into position under the cranes and bring them up through the well and get enough sailors with enough lines [to stabilize helicopters on a rolling ship].

The LSDs were great for rolling. They were a flat-bottomed thing, and they spent a lot of time lying on one side, then lying on the other side. So the ship's crew had to get very good with all the [belaying] lines to keep from damaging the helicopters as they handled them. So it was good practice for them. It was good practice for us, because we could run a good long mission out to sea. Just to train ourselves, we'd go off in some lateral direction. Instead of going right

down the course the ship was going to, we'd go off in a lateral direction, then turn and calculate an intercept. So we'd see if our co-pilots were running the plot board right.

That was kind of the typical deal. Then we'd be gone, usually, at least two weeks, depending on where we were going. Many of these trips, the flight would be aborted or not launched or whatever, so we'd just turn around and plod our way back to Norfolk.

The LSD, the one we went on most often, was one called the LSD *Fort Mandan*. The *Fort Mandan* was not fast. She did 16.8 knots flat out. That's all they could get out of that ship. So we spent lots and lots of time running at 16.8 knots, which made the destroyers look like speedboats when they'd go by.

WRIGHT: Would you talk to us also about the crew? How did people become part of your Marine Air Group? Was this something that they could volunteer for, or were they highly selected? What were some of the traits that these men needed to [have], to be part of this group that was part of the recovery and retrieval?

KOONS: The Marine Air Group Twenty-six was a standard helicopter air group. We had two squadrons of medium helicopters, which was what I was flying, one squadron of heavies, and then an observation—I think it was called an observation squadron. They had some light helicopters, and they also had some lightweight fixed-wing airplanes that were used for artillery and forward air-control spotting. A Marine air group of that size, we had about 100 helicopters, therefore about 250 officer pilots.

This was just a normal assignment. When I came out of flight school, it was just routine. I got assigned to Marine Air Group Twenty-six. People that I came out of flight school with got

assigned to other air groups. The Marine Corps at that time had three Marine air groups that that's what they did; they flew helicopters. Their mission was to go aboard ship, typically for amphibious assault work. At that time it was called vertical envelopment, and we would take, initially, the Pathfinders. If you're going to assault a beach, we'd take the Pathfinders in sometime prior to the assault, and then maybe a battalion-size unit would go in by air and be dropped somewhere inland so that it was part of an envelopment operation. You were, therefore, behind the enemy's beach defense, and you could cause all kinds of problems with a battalion-size force behind their lines, basically, is what the idea was, a very general idea. So, no, it was a routine assignment for people to be assigned to it.

Now, the selection of the people who flew the Mercury missions was a little bit different brand of cat. It was very unusual within the Fleet Marine Force to have that kind of a mission assigned. It was unique. There was no other time that I ever heard of in Marine aviation, at least with helicopters, that anything like that was done.

Basically, the people who did it were volunteers. They were interested, and they came and said, "I want to do that. Can I get on the list to train for that mission?" Generally, they were the younger guys who were—well, in the case of the co-pilots, they were all younger, because everybody moved to aircraft commander, with few exceptions. That was just the normal thing. You came out of flight school and you flew as a co-pilot for a year or so, and [when] you finished your training, you were ready to check as an aircraft commander.

The aircraft commanders, the ones who really completed the training and said, "This doesn't bother me too much. I'm fine with doing this," tended to be younger guys. We had, as I can remember, we had a couple of majors at that time, people who were probably in their early- to mid-thirties, who said, "I think I'd like to try that." Both of them said, "I don't want to fly that

anymore," after they'd done three or four training missions. I guess they just realized that it was enough different and required enough mental and physical adaptation that it was so different from what they were used to doing, and they didn't feel they were comfortable with it. So they said, "We'll let you other guys take care of that." I think that everybody who did it volunteered, came, and said, "I want to do that. Would you put me in the training cycle so I can do that?"

WRIGHT: Part of what they were told, from what we understand through research, is that the safety of the helicopter and the crew was secondary to the spacecraft and the astronauts.

KOONS: Yes.

WRIGHT: Were there any times that you recall that that issue came up, as far as someone had to make that judgment of putting their own crew in jeopardy to save the spacecraft?

KOONS: I made the judgment that if people were going to do that, if we were going to do this mission, that the crews had to accept, and fully accept, the idea that the helicopter and its crew came second to the spacecraft, not just the spacecraft, particularly a spacecraft with a man on board. Even though we had come to the point that the normal procedure was to extract the man and bring him back inside the helicopter—and under those conditions, of course, if you had an emergency like an engine failure, control failure, or something, you're just going to pickle the spacecraft off and concentrate on survival. But it was also possible that the crewman, the astronaut, might be disabled, [or] the hatch might not work. There are a few things you can think of that you might wind up carrying the thing back with the guy still inside it.

So I made the judgment that the crew had to accept that if we're doing it that way, if the guy's still in the spacecraft, he gets all the priority you can give him as far as leaving that spacecraft afloat. The typical thing you think of is an engine failure, because that was the most usual thing that would bring you down, was an engine failure. So I made that judgment, and I wrote it into the operations manual, and the squadron commander signed it, and that was the end of the discussion.

There were some pretty spirited discussions when John [H.] Glenn found out that that's the way it was written. He took me on head-on about that, and he basically said, "Lieutenant, if you're carrying me around there," he said, "I want you to drop me and just take care of yourself."

My response was, "Colonel, I can get killed any day of the week, and I won't get written up anywhere but the hometown newspaper. If I kill you, we're not going to hear the end of it for a year. So it's not reasonable to say that I would give myself the priority over you. That's just not the way it works." He didn't like that, but he quit arguing with me.

WRIGHT: Tell us about your progression. You first started out, as you mentioned, I guess as a lieutenant when you first began the operations?

KOONS: Yes.

WRIGHT: And then how your role evolved.

KOONS: The most interesting turning point was that in addition to doing the Mercury missions, my squadron was tasked with providing, I think it was ten helicopters and about thirty pilots and the enlisted people to do all the support for the Mediterranean missions. The sequence there, the typical sequence was, they were transported over in an LSD, then they flew off the LSD to a carrier, and they were on a carrier or the LSD or both in the Mediterranean area for a period of six months, and then they came back home.

The basic force that was deployed was called the Med Battalion, and the Second Marine Division provided a reinforced battalion in the Mediterranean area. This is now in the late fifties, early sixties. That was part of their standard deployed posture, was that they had a ready-to-fight battalion in the Mediterranean at all times. That's quite a load on a squadron. We had at that time really about a dozen pilots set aside as Mercury pilots, and it was basically everybody else in the squadron [who] had to go to make up that Mediterranean battalion, and then we'd get replenished when the unit came back.

The squadron commander called Larry Flanagan and I out in the hall one day, and he said, "One of you two guys has to go [on] deployment. Do one of you want to volunteer?"

Larry and I just looked at each other, said, "No, sir." [Laughs]

So he promptly hauled a quarter out of his pocket and flipped it, and Larry went [on deployment]. That was a turning point. If the thing had come down tails, I'd have gone [on deployment] and Larry would have been the Mercury Project Officer, and who knows how it would have all worked out.

As I told you, I made aircraft commander, and I was the Mercury Project Officer virtually [full-time] then. I don't know when Larry got [transferred]. I can't remember when that was. I had been his co-pilot for two of the tests that were flown out of Wallops Island. Then I got rated

as an aircraft commander and got trained in the Mercury work and continued, then, to do that until after the Shepard flight. [After that I was] transferred to Group Headquarters, and I was no longer actively involved.

Throughout that entire time, I was a first lieutenant. I was selected to captain right close to the end of that time. When I left the squadron, when I left active duty, I went to work for the Space Task Group. I was employee number 87. I'll never forget that. I was the 87th employee to sign on with the Space Task Group.

At the same time, I went to a jet attack squadron, a reserve squadron, in Norfolk, and I got my promotion to captain there. I flew with that squadron while we were still in Langley Air Force Base, which was several months. Then when we moved to Houston, it worked out that my work was keeping me busy enough that I didn't really have time to put in the time to stay current in a jet aircraft. That was the available unit here, was you went to Dallas [Texas] and flew with the squadron in Dallas. I just didn't have the time to drive back and forth, or fly back and forth. My experience had always been, if I laid off of flying for a month, I didn't feel really comfortable. It took a couple of flights before I really got back in the groove. I thought going up there once a month was a bad idea.

So I went into what was called a volunteer training unit [in Houston], and eventually I got two more promotions. I wound up a lieutenant colonel. I was the CO [commanding officer] of that volunteer training unit for a few months. Then somebody more senior joined, and [he] became the CO. So that was my military progression.

We haven't talked about the Shepard flight.

WRIGHT: Yes, I was going to ask you that. Before we do that, do you have any idea just how many training missions that you went on before you picked up Shepard?

KOONS: No, I don't. And it's not reflected in my logbook, either. I looked. I could probably tell you how many deployments I went on, and that would be a dozen or so, but I can't tell you how many times I picked up spacecraft.

WRIGHT: Let's talk about the Shepard flight.

KOONS: As the time for the Shepard flight approached, the squadron commander called me in. Of course, we had a lot of pilots who were qualified to do it. They were Mercury pilots who were senior to me. The squadron commander called me in and told me that it had been decided that I should have the lead for that mission. He asked me if I had a particular choice in co-pilot, and I said, "I sure do," because at that point I had been working for several months regularly with a co-pilot named George [F.] Cox. George and I just really got along well. We were kind of like twins. You know, we didn't have to say everything that we communicated. We thought alike and we worked well together. We were comfortable with each other. And George was really eager to do it, enjoyed working the mission. So that was the basic setup.

We didn't find out until late that we were going to be on a carrier instead of on an LSD. [This would be only the second time] to work off a carrier. Of course, we were all carrier-qualified, but the whole thing of handling the spacecraft and putting it on the carrier and so forth was not something that we had done any [significant] planning [or training] for.

So when it turned out we were going aboard a carrier, I'm not sure how, [but] we got a boilerplate [spacecraft] there. Whether we took it out to the carrier or whether somebody had put it on the carrier before [we] embarked, I don't know.

When we did some training on the carrier, there were several things that went on there that really caught me by surprise. Number one was the intensity of the press coverage. There was a press pool aboard, and I wound up giving what amounted to press briefings—I guess that's what you'd call it, press conferences—and getting interviewed a number of times by people. All this was a real surprise to me. I had not been exposed to the media coverage thing at all other than somebody writing something up in the newspaper, which was usually some Navy or Marine [Corps] press release kind of thing. That was just all brand new to me.

We did some flight training right away after we got aboard, and the air boss had set the flight deck up and put the skid with the mattresses on it up close to the bow. So we went off, and one of our helicopters dropped the boilerplate into the water, and then we went and picked it up and brought it back to the ship. We discovered in short order that was almost impossible to do, because with that twelve-foot sling and an eight-foot spacecraft, and then the hook [hanging] below the helicopter, my eye level was forty or forty-five feet above the flight deck. But when you're up on the forward end of the flight deck, there's 1,100 feet of flight deck behind me that didn't do me any good at all as far as visual reference. As far as I was concerned, I was 100-and-some feet [above the water] trying to maintain a hover to put this thing down within a foot or so of where we wanted it. It just wouldn't work.

We got that straightened out. The Navy guys were very cooperative, and the air boss rearranged his flight deck. They shifted airplanes around and put the skid way on the back end of the flight deck. So then when we tried it that way, it was much better, because I had the island

in my field of view, and out the front windshield, I could see the front part of the flight deck. So it made it much easier, a lot easier to maintain a good visual reference while I was setting the thing down.

That was about the only major thing. The other thing was that that was an ASW [Antisubmarine Warfare] carrier normally, and they had some Navy helicopters that [were] the same type, but they were the antisubmarine warfare helicopters. They used the dipping sonar. So when we went to pick up Shepard, much to my surprise, here [were several] of these Navy guys flying wing on us, and they're all sitting there with their cameras, ready to take pictures, which they did. And that's some of the pictures that you see of that, were taken [by] the Navy. There's a lot of resource on a carrier that we weren't used to having available.

WRIGHT: If you don't mind, before you get into any more details, we're going to stop just for a second and change this tape out so we don't miss anything.

[Tape change]

WRIGHT: We were talking about them taking pictures and so many more resources you had on a carrier.

KOONS: Yes. Going back to the press coverage for a minute, I was really [surprised] by that. I learned a great deal about the press after the mission, because when I got back to the beach, I read some really incredible accounts of how that was done. There was one press [pool] guy from UPI [United Press International] who, as far as I could tell, his standard state was inebriated

while he was on the ship. He wrote this extensive coverage which appeared in *Newsweek* and a number of magazines that carried UPI, which told this really phenomenally impossible deal about how one helicopter swooped in and engaged the spacecraft and the second helicopter then came in and snatched the astronaut. It's just physically impossible. But I had people for the next ten years asking, "What was that second helicopter?" People really locked on to what was going on.

There was lots of really good coverage. As we realized the need (we hadn't really come prepared), we really gave a lot of just chalktalk kind of briefings for the press. I wound up doing a number of those and doing a number of interviews. Like I said, that was all a totally new experience for me.

There were three people that I really appreciated that were very, very adept and very accurate at what they did. One was Herb Kaplow, who you may remember. I think he's dead now. He was with NBC, was a television guy.

A print writer named Jack Fox, who was with one of the tabloid-size papers in New York City, but Jack was excellent. I mean, he listened and listened and asked questions until he really understood what he was going to write about, and then he did an excellent job of writing up what was going on.

The other guy we all appreciated was Dean Conger, who was a photographer with *National Geographic*. He was part of the pool. He had been out with us on one prior mission, I think. Dean showed up with a camera that he asked to clamp onto the side of the helicopter, where it would be looking down as we did the retrieval, with a wide-angle lens on it. I can't remember how many exposures he said it had. It may have been just a standard thirty-six-exposure roll. But he said it was automatic, and he could set it up to just take one shot a second,

and, number one, if it would be okay for him to clamp it onto the—it was actually on one of the little struts that held the [personnel] hoist, or the rescue hoist. And the other thing, if we could just remember to turn it on when we started doing the pick-up, why then he could say—well, that's what wound up on the cover of *Life* magazine, is that one that you see—you see the back of George Cox's head and Shepard coming up with this—you can't really tell whether he's smiling or not, but he was almost in the helicopter, and he was pretty happy about that.

Those were the three people that I remember that were just really outstanding.

Anyway, the day of the flight, [we] had the standard delays. Since we had the facility and had been able to launch whenever we wanted, we took the helicopters out for a little shakedown. Part of our protocol that we had for the helicopters and the crews was that the best go first. The lead pilot and his co-pilot were, I think, morally obligated to say, "I don't feel good today," and turn it over to number two.

By the same count, if the helicopter wasn't quite right, then we'd rotate that. So even though we were on a carrier and had all kinds of room, we still had this three-helicopter deployment and seven pilots and so forth. Major George Ross was our detachment leader.

But when we went out to shake out the helicopters, the one that I was flying had been the one that I flew to pick up the Mercury-Atlas unmanned flight. The guys down on the line had painted a spacecraft on the side of it, had it all duded up. But when I went out to fly, the ASE had a twitch in it. So I called number two, whoever was flying that one, and said, "How's your [aircraft] working?" and so forth. So we just made an on-the-spot decision that that aircraft got moved back to number three position. Then the crews all rotated, and I took over the number two [aircraft], which turned out to be the side number 44, which was the one that you see all the pictures of.

The launch was delayed. Of course, that's pretty typical. I just [laid] down and took a little nap on the flight deck. We were ready to launch, and they told us there was going to be a forty-five-minute delay or whatever it was, so I just stretched out on the deck and caught forty winks, which felt pretty good, because we'd been up since way early that morning.

As I remember, we didn't get to do things exactly like we had set out. The air boss got nervous and he said, "Launch," so we launched. But that, again, was not a big deal, even though—see, our whole mission plan was developed around operating off the LSD, where you could only do one helicopter at a time. So launching off the carrier was no big deal, because if we needed more fuel or less or whatever, you could come back, and it was just a matter of a couple of minutes to add fuel. So that was not a big deal.

So we were airborne when the [spacecraft's] main chutes opened and [we] spotted the thing shortly after that and just watched it come down. As we saw we were close aboard, why, George was up in the cockpit with me. He went ahead and shinnied down and got in position down below, so we were already in position to retrieve the spacecraft.

We talked to Shepard on the radio. He was still reporting back to mission control, although I don't think they could hear him at that time because he was down on the water. I don't know if there was any kind of relay airplane that would let them maintain radio contact with the control center or not.

The landing was uneventful. The main chute deployed, or separated, and went into the water, which is something we always had to watch out for, because if there was any part of that main chute above water, you ran the chance of the rotor wash picking it up and inflating it again. So we had to be sure it was off and sunk in the water so it wasn't going to come up.

We kept waiting for the antenna to pop up, and we never did see it. So we finally said, "Well, okay," and we moved on into position, and George stashed his antenna cutter and got his hook out and snagged onto the spacecraft. It was a state-two to -three sea, not particularly difficult to handle. It was all pretty routine.

We pulled up into position, and I reminded George to turn on the camera, and he said, "I've already done it." We just went ahead and pulled the thing up and got it up out of the water and told Al it was okay to come on out. So he opened his hatch (it was a mechanical hatch). He opened his hatch and got up on the sill, and we picked him up and took him [and the spacecraft] back to the ship, set it down and landed.

I told George just to stay down below, because we were just a mile or so from the ship. We set it down [on the ship] and then just moved forward and landed close by where it was.

We had been given some warnings by [one of] the astronauts' flight surgeons, saying, "Now, you've got to keep an eye on him. We're not sure what he—this is for the U.S. the first time a man's weightless in space." They sort of said, "You've got to keep an eye on him. We're not sure if he's going to be in his normal state of mind," which we thought was sheer goofiness, because the Russians had already orbited a guy for a day.

Anyway, the next thing I knew, I was busy shutting the helicopter down, and here Shepard in his silver suit minus the hard hat, comes slithering up by the co-pilot's—through the space where George would have come up if he were going to get up in his seat. He reached over and whacked me on the leg and [said], "Good boy." Then back down he went.

WRIGHT: Had you [had] any interaction with him before?

KOONS: Oh yes. Yes, we had worked with all the first seven, knew them all pretty well. We had done a lot of egress training. I didn't realize it at the time, but when they picked Shepard to fly the first flight and Grissom as his backup and then John Glenn was identified as third, all of a sudden we started doing the egress training with those three guys and not the others. I didn't realize it at the time, because they hadn't announced it, but it was a tip-off that the crews had been selected. I just didn't pick up on it. Yes, we knew all the first seven during that time.

WRIGHT: Tell us about as Shepard left your helicopter, was that quite a moment that was captured?

KOONS: Oh yes. And again, that's a thing I don't remember particularly well, because as he was getting out, I was still busy going through the shutdown process in the cockpit. George hopped down to help him out. George told me the other day, he said, "You know, they really got that messed up. I got identified as a Navy crewman." George didn't appreciate that. [Laughs]

I don't know. Then all the hubbub started, which we were unprepared for. I got summoned up to the flag bridge two or three times in the space of two hours, because somebody was—there was an admiral on board or a commodore, one or the other, and I had to go up and provide personal information and answer questions and whatnot.

Then the carrier closed [to] about eight or ten miles overnight, I think, and then the next morning we flew the spacecraft into the beach, back to the Cape [Canaveral, Florida], and set it down. I don't remember exactly where we set it down, but that's when the news coverage came in earnest. There were print reporters and TV crews. At that time they did everything on sixteen-millimeter cameras. So they'd get us out with these cameras, and we did lots of

interviews. It was a heady time. That was something to [a] twenty-five year old or whatever I was, twenty-six—it wasn't really in my scope of experience to get subjected to all that kind of intense scrutiny.

WRIGHT: Did everything go as well as you had expected when you retrieved Shepard and the capsule? All the training had paid off?

KOONS: Yes. Oh yes. The only anomaly we had was that that antenna did pop up sometime. I'm not sure when it did, but we found a dent in the bottom of our helicopter, because it blew the top three or four sections off, and they went shooting on up and made a little ding in the bottom of the helicopter. But I never knew when that happened, when it finally decided to go. If you look at the pictures, there's the stub of it. There's like two sections sticking out of the top of the spacecraft when it's sitting on the deck. Other than that, there were no anomalies. Everything worked just fine.

WRIGHT: So the next step was you began training for the next [mission]. Or did you—

KOONS: No. We got what for that time was a live TV deal. The *I've Got a Secret* people called, and George and I and our wives got a paid trip to New York, and they put us on *I've Got a Secret*, which was kind of a—I don't know. I think the panel just played with us, because there we [were], we were in civilian suits, but we had these sidewall haircuts, which was a real giveaway that we were military. Since it was just a few days after the flight, it wasn't really difficult to figure out.

WRIGHT: That was quite an experience, wasn't it?

KOONS: Yes. For a couple of young guys, that was quite an experience. Let's see. I was trying to remember who the panel were. Johnny Carson, Bess Meyerson. I don't remember who the others were, Henry [Morgan]. Probably none of you ever saw him on that show.

WRIGHT: We won't confess that on a recording. [Laughter]

KOONS: But that was an interesting time. It was kind of an interesting highlight from all the work we'd been doing, to get cleaned up and go to New York.

WRIGHT: No kidding. That wasn't a normal deployment for Marines at the time, was it?

KOONS: No. When I got back to the station, I got transferred to the Group Headquarters. There was, by that time, a Group Mercury Project Officer, because there was another squadron. The heavies, heavy helicopter squadron, had the mission of doing the retrieval in the event of a launch abort, so they would fly out. And there's a whole story on—you can pick that up from Pete Armitage's narrative, because he worked with them. I never did work with that squadron very much.

But anyway, they transferred me over to the group to be the Group Project Officer, and I was there for about four months. Then my contract was up, and [I was] offered a position with the Space Task Group, and so I made that transition.

WRIGHT: Was that before or after the Grissom—

KOONS: That was after the Grissom flight. At the time of the Grissom flight, I was assigned to be in the control center at the Cape, and when the word came that the spacecraft had been lost, Bob Thompson was the recovery manager, and he grabbed me and he said, "I want you to go with me. We're going to get a Navy S-2F (administrative airplane) and go down and talk to Gus and talk to the helicopter crew and see what happened." So that was all completely ad lib.

We got on this thing, and it was a little over an hour flight. We got down there, and they had just brought Gus in from the ship and taken him to the little Air Force medical facility there on GBI [Grand Bahama Island]. He was still in his flight suit and still was all wet, because his neck dam had leaked and he got a bunch of water in the suit. He was pretty tired and pretty uncomfortable.

As I recall, he was set up to debrief on mission phases, and after the mission, he was supposed to use cue cards and talk into a tape recorder and talk through pre-launch and then talk through launch and then talk [coasting flight] and talk through descent and landing. Bob said, "Gus, help us out here. Would you mind doing your last card first?"

So Gus started just narrating what had happened and described how everything was nominal, he came down, got in the water, got the main chute off, and he verified that so he didn't have to back that up. There was a backup function where he could pickle off the main chute if [it] didn't separate. He said he was moving around, getting things stowed and getting ready to get out.

On that hatch there was a safety pin. It's kind of like the safety pin on a hand grenade. You know, you slip it out to enable the control to move. There was also, I think, a cover over the button that you used to explode the hatch. The hatch had this initiator in there, but what actually separated the hatch was a ring of Primacord that went all the way around the hatch. Then it was secured with a bunch of bolts that had been weakened by being [necked] down. The Primacord caused the bolts to fail, and so the hatch was really bolted in place and sealed. Then when you exploded the primer, which set off the Primacord, it blew the hatch off. There'd been some tests done, and the thing came off, a big bang, and it really blew the hatch a good distance.

So anyway, he had taken the cover off and pulled the safety pin preparatory to getting out. But there's still, the way that thing's configured, there's a ring around that button, and it just doesn't seem possible that he made contact with that. Certainly, based on his debrief, he certainly didn't do it deliberately, and it's hard to see how he could have possibly done it accidentally, because the way that button is down inside a ring, a cylindrical protector, you have to be very deliberate about it to make that thing go off.

He talked through that, and we talked to the crew, the helicopter crew. They had been sent in [to GBI] at the same time. So we got on the S-2F and went back to the Cape. I was not involved in the NASA discussions. I'm sure Bob was reporting to Dr. [Robert R.] Gilruth and Chris [Christopher C.] Kraft on what he had learned on his trip down to talk to Gus and what we had learned when we talked to the helicopter crew.

What we learned when we talked to the helicopter crew was that things went pretty nominally. By the way, that aircraft commander was Jim Lewis, James L. Lewis, Jr. He lives over in Willowbend now. He's here in town. He is the guy I had known since I met him in flight school, and we had been together on and off in our Marine Corps tour. Then he came to

work for JSC a few months after I did, so we've known each other for forty-something years now.

The co-pilot was [John Reinhard], as I remember. They had pulled into a hover and were waiting for Gus to tell them that he was ready to be picked up, and the hatch blew off. The next thing they knew was that—of course, Gus realized the spacecraft started shipping water, and he came popping out right [away]. He didn't waste any time at all about getting out of that and into the water.

So the lead helicopter [crew] realized it was starting to sink. They said, "Let's see if we can get it." And they moved over, and the thing was already under water when they got there, got moved into position. And Jim laid the [helicopter] down in the water. You can see the wheel literally went in the water. He put the whole belly of the [aircraft] in the water, and [John] reached with his pole down probably six feet into the water and got it engaged. So it was already sunk and gone when they got hold of it.

Then they started trying to pick it up. Well, it was full of water. They got [some of] the water drained out of the cabin all right, but they couldn't even lift it high enough to begin to drain the bag full of water that was down underneath. So they were sitting there grinding away at a fairly high power setting.

They would have had a while to think it over and see if there was anything that could be done. Of course, one thing that immediately comes to mind is they were only a short distance from the ship. The landing was almost exactly on target. Maybe the ship could have sent a long boat over with a good, stout line and gotten a hold of it to keep it from sinking. But those options were all precluded because one of the systems, or little systems, on the helicopter is what's called a chip warning light, and it's a light that's right between your eyes when you're

sitting in the command seat, and it's bright and it's yellow. This light came on, and what that's telling you is that the engine internally is shedding some steel, because the detector is two magnetic points, and if you complete the circuit between those points, that light comes on. And that's a startling experience.

I had that happen to me one time. It had nothing to do with Mercury. I was flying an administrative run, and all of a sudden the light came on, and that really gets your attention.

At that point, Jim Lewis was confronted with the choice of "Now what do I do?" Typically, when the light comes on, the engine will run for a little while. It's also typical when the light comes on that it's just [caused by] a chunk of carbon that's come loose inside the engine that happened to lodge in between those electrical points. So he had no way of knowing which it was. He said he thought about it for a little bit and finally decided, "I really don't have a choice," so he pickled off the spacecraft and got his helicopter back to the ship.

While all this was going on, Gus was in the water, and he had two things that were giving him trouble. One was that his neck dam, which he had deployed—he'd taken his hard hat off and stowed it inside the spacecraft, and then he had deployed the neck dam, which is supposed to give you a watertight seal from the ring for the hard hat. The neck dam is outside that, then you pop it over it. It's a rubber diaphragm-like thing, and it's supposed to snap tight around your neck. His had been stowed in the position so long that it didn't really get tight. So when he went in the water, it was leaking, and he was taking water in through his neck dam.

The other thing that was giving him a little bit of trouble was he had stashed a roll of dimes in the leg of his suit for post-flight souvenirs, and he said that he really regretted putting those dimes in there. [Laughs] Probably, if you think about it, the dimes really didn't amount to much, because that's an incidental weight compared to everything else that was bothering him at

that time. But he was getting fairly low in the water and not at all happy about what was going on.

Jim Lewis and his co-pilot realized that he was not doing well, so while they were pulling away, trying to get the thing out of the water, they started moving sideways to get away from Gus to leave him room so that the second helicopter, which was flown—the aircraft commander was Phil Upschulte. He was a captain. His co-pilot was George Cox. So they got in position and got the collar down to Gus and got him out of the water.

Gus commented during the debriefing, he said, "When I looked up and saw George," he said, "that was really comforting," he says, "because George and I had done most of the training for this." So that was the face he was used to seeing when he looked up at the helicopter, was George there with his yellow striped hard hat on. So [George] got to be the only guy who's ever retrieved two astronauts out of the water.

WRIGHT: Was that a little strange for you, to be away from the helicopter retrieval?

KOONS: I didn't like it at all. No, I really did not like that, but it's also obvious you weren't going to be able to do that forever. So it was time to move on.

WRIGHT: What were some of the duties they were asking you to do, being out at Group Headquarters?

KOONS: Mercury Project Officer. Believe it or not, there were reams and reams of classified documents that related to the project. I think when I first got involved, to go back to the very

first, I think the project was still classified at that time. I'm not real sure of that. But anyway, it was not very long at all until they named the first crews and it was all declassified.

But because it affected force structure, force deployment, force utilization, a lot of the work that we did was classified, and some of it was fairly highly classified. I think in those days people had a tendency to use a higher classification than probably would be necessary in a different world environment. But you know, that was right at the peak of the Cold War when things were really bristly between the U.S. and NATO [North Atlantic Treaty Organization] and the Soviet Union.

I spent a lot of time weeding—I got rid of an awful lot of classified documents that my predecessor had stashed there for some reason and [that] were out of date. I did the liaison with NASA. … There wasn't a whole lot to do. I was a maintenance test pilot for my squadron before I went to the group, and they didn't have any other maintenance test pilot, so they were calling me a couple times a day to come and test an [aircraft]. I was rated as an advanced instructor by that time, which meant that I could give instruction in full-power-off auto-rotation all the way to touchdown, which actually I feel is safer than trying to recover with power without hitting the ground. So as people got ready to be aircraft commanders, they'd call on me to take them out for their couple of flights to give them instructions in full-power-off auto-rotations. So it was that kind of stuff.

WRIGHT: How did you transition into being the eighty-seventh member of the STG?

KOONS: They hired me, and I moved. That was all there was to it.

WRIGHT: Who approached you about transferring over to NASA?

KOONS: I approached them. I talked to Pete Armitage and Bob Thompson, who were the people I had principally worked with for the last couple of years. We got it worked out, so that's what happened.

WRIGHT: Now space business was a new business. How did you decide that that's where you wanted to move your career?

KOONS: You know, I worked at that decision. I had a friend who had gotten off active duty a few months before I did, who had gone to work with the airlines. He was calling me once a week, saying, "Man, you need to come and do this." He [said], "Soon as I get through this first few months of probation," he says, "I'm going to be making all kinds of money," and so forth. And he was right for him, because he became the chief pilot for Continental Airlines. That was a pretty high position there.

Our squadron flight surgeon told me that I ought to go to medical school. He said, "I'll guarantee I'll get you into—," the medical school he had gone to. I had to give that some serious consideration, but wasn't really, at that point, sure I wanted to dive into three or four years of really intense educational endeavor again.

And [the STG] was just really appealing, because I knew a few of the people. I knew all the crew. I knew quite a few of the people at NASA, and I knew a lot about what the plans were, and I just really had a feeling I wanted to stay involved in that. So that's what I did.

WRIGHT: Even though it meant a move to Houston, you were ready to go?

KOONS: No. At that time, it meant a move to Hampton, Virginia, because the Space Task Group was still at Langley [Research Center, Hampton, Virginia]. It wasn't until after we had—well, about the time we were moving, that the announcement was made that the Center was going to be built here. So that just gave me a signal to rent instead of buy when we got there. Then we were having our first child [Deborah], who you met here, about that time. So she was born in Virginia.

WRIGHT: What was it like joining the group? Especially since we are just now marking the passing of Max [Maxime A.] Faget, you were part now of the STG, which was he was such an integral part of, tell us what it was like those days that you joined and all the planning and development and how you became involved with that group.

KOONS: I joined the Recovery Branch, and I actually didn't even know Max Faget then. I don't think I'd ever met him. I had met some of his people who were working with Recovery, helping out with things like sling design and the hook design. The hook was a special design. They really worked at that to keep the weight down.

I principally worked with Thompson's group, which numbered about 12 or so at that time. We were set up to deploy for missions. The people would be sent out on the ships as the NASA guy to [do] all kinds of liaison things, you know—source of information for the people on board the ship as far as what's the mission; what's the probability it's going to land here there, or wherever; how do we get information; what do we do with the spacecraft; will we get it back—

just a whole broad range of things that the NASA rep [representative] went aboard to take care of. That became a major activity over the years, because we had ships deployed all over the world, literally, for the later Mercury flights and then the Gemini and Apollo [missions]. I did two of those deployments over the years, but basically I was working more in design and engineering kind of endeavors, rather than direct operational work.

WRIGHT: Is that something that you would like to get in the details of today, or do you want to save it for the next session?

KOONS: How long do you want to go?

WRIGHT: We'll go how long you want to go.

KOONS: I could tell a little bit about some of the very first things that I did there. One of the first things they put me to work on was—by that time, there was a very vague definition of what the Apollo spacecraft was going to look like, and even though the mission didn't settle down for quite a while, there was the Earth-orbit rendezvous and all kinds of different things that they talked about that hadn't settled. But the concept of the re-entry module, the command module, which was what we were concerned with, was the thing with the crew in it that came back into the atmosphere--that was reasonably well defined, and we had a pretty good notion of what that was going to look like.

Somebody had already done the very initial part of the contract with Grumman [Aircraft Engineering Corporation] up at Bethpage [New York], and I think they had proposed it, and it

was to study the possibility of using fixed-wing airplanes to pick up a spacecraft from a remote location. The way they proposed to do it, somebody had done things like the Air Force was using the energy-absorbing winches in direct engagement. They were picking up camera modules from the orbital spy satellites out over the Pacific with these things where they would literally fly the airplane into the parachute, and hooks would engage the extra-strong shrouds in the parachutes. Then the energy-absorbing winch would let it run, kind of like an arresting engine, it would let it stream out until they got it accelerated, and then they'd reel it back in.

Somebody had looked at that, and they said—at that time the command module was projected to weigh, I think, 8,500 pounds or so. They said, "That's a lot of weight to try to get going 130 knots in a few hundred feet." So they pretty much dropped that.

But then Grumman had proposed using a long-line retrieval. This goes clear back into the twenties, when airmail was delivered this way. What they would do, they'd put an airmail pouch out of your typical, say, biplane, and they would reel it out on a long line, long hunk of rope, for over 1,300 feet. Then the pilot would start flying in circles around where he wanted that thing to sit down. He would tighten up his circle until the line then became a descending helix and the bag at the bottom would be almost stationary. Then he'd just lower his altitude a little bit and place it on the ground. And it worked. It was done a lot. The guys on the ground, then, would grab the line, snap the new bag on, and then he'd just fly out of his circle, and the airplane would reel it in, and they'd get ready to go on to the next [stop]. That was air mail with a vengeance.

Anyway, Grumman had proposed an [evaluation of] doing that with a big airplane to pick up an Apollo spacecraft. Say it was down in the Indian Ocean or somewhere. They said, "Let's

check this out." So there was this study that was just getting cranked up, and I was named as the project engineer on that.

Computers were just coming into use then. Some of the early mainframe computers were in use. Some engineers were taking to the whole idea of [simulation] computing like ducks to water. They were really getting into it. Anyway, the concept was to do some experimentation with a—they used a Grumman Ag Cat, it's an agricultural spray plane, and they mounted a reel in it and so forth, and they rigged the line up so they could take pictures of it. [The pictures were used to validate full-scale computer simulations.] They did some actual deployments where they set things down and picked things up with this line. It's kind of like a quarter-scale version of what you would do. So that was one of the things I did. I was the project engineer, whatever you call it, on that effort.

We went so far as to—it was kind of like a Phase A sort of study. We went so far as to actually size how much line strength would we need, how would you make a line like that, how long would the line have to be. The answer is like 11,000 feet, two miles of line, literally.

And the next question, then, you come to is what do you do with two miles of line inside an airplane? So we were looking at this, and it was maybe possible, but it didn't really look feasible. At some point after we had worked on that for several months, I went to Thompson and Armitage and kind of outlined what was going on and said, "You know, this has been very interesting, but if you think about the operational aspects of trying to do that with a spacecraft," I said, "if I was in charge, I would vote to wait for the ship to get there, just figure out a way to keep it afloat and keep things under control until we could get surface support there, because that would have to be a hairy way to go, to pick that thing up on two miles of line and try to reel it in

and so forth." So they agreed with my recommendation, and we terminated that effort. That was the end of that.

WRIGHT: Were there other similar projects that you worked on?

KOONS: Fortunately, no. [Laughter]

I guess I'd like to knock off. I'll spend some time this evening thinking about—

WRIGHT: We'll stop for now, then.

[End of interview]