ORAL HISTORY TRANSCRIPT

DAVID D. EWART
INTERVIEWED BY SUMMER CHICK BERGEN
LAGUNA HILLS, CALIFORNIA – 6 MARCH 1999

BERGEN: Today is March 6, 1999. This oral history interview with David Ewart is being conducted in Laguna [Niguel], California, for the Johnson Space Center Oral History Project. The interviewer is Summer Chick Bergen, assisted by Carol Butler and Rebecca Wright.

We're so glad that you're willing to share your history with us.

EWART: Nice to have you here in not-so-sunny Southern California.

BERGEN: Why don't you just begin telling us a little bit about your time at AVRO and how that led to your involvement with NASA.

EWART: Yes. I joined AVRO in late [19]'53, fresh out of flying training with the Royal Air Force, and it was a great five years in Canada working on the AVRO Arrow. They were making the CF-100 all-weather fighter, but the AVRO Arrow was the one that I was working on, along with several thousand other people.

You mentioned Sputnik. That happened in [19]'57. We were fascinated as Sputnik passed overhead on a late evening sky over Toronto, but, of course, we were not in the space business at that time. So it was very interesting, but it didn't have too great an impact. We were busy doing what we were doing. '57 was the time when we rolled out the first prototype of the AVRO Arrow, so that was another milestone that I can distinctly recall, and it was a very successful program in the test-flying phase of the Arrow. We exceeded performance specifications for the interim J-75 engine, 15,000-pound thrust, and we got to Mach 1.96. The spec was 2.0, with the full-up Iroquois engine, which was about roughly

20,000-pound thrust. And it was a great plane, way ahead of its time. It carried the missiles, the Sparrows and Falcons, internally. We haven't seen that design again until the F-22. The F-22 carries the missiles internally. This gives you a low drag configuration for a reasonably economic supersonic cruise. The F-17, I guess, carries its bombs internally. I haven't seen it carrying missiles.

The money for the Arrow was—I sent you the information on that—was highly political. I won't go into great depth on that. It did lay off several thousand people. The figures vary between 13 and 15,000, which at that time was quite a percentage of the Canadian aerospace industry. The big ones were just Canadair in Montreal, and AVRO, and deHaviland in Toronto.

Fortunately for us at that time, NASA just had started up in late '58. The Space Task Group [STG] had started about the same time, and they were anxious to get engineers. But at the same time, the Century Series [fighters] were being designed and test-flown, and there was a big demand for engineers in the United States, so that's why they came to Canada.

I remember Bob [Robert R.] Gilruth, Charlie—I've forgotten the name, he was a deputy at the time, and Paul Purser came up—Charlie [Charles J.] Donlan. Charlie Donlan and Paul [E.] Purser interviewed me, I remember. I probably couldn't have created too good an impression because I was flying with the Air Force Reserve at the time, and having been laid off, I was flying more than usual. So I came to the interview in uniform, ready to go back to the airport and pick up a C-45 and fly it to Montreal, and we were running a little late, so I was hopping from one foot to the other, anxious to get off and fly to Montreal. But anyway, the interview apparently went okay because they hired me.

Most of us came down in the spring of '59. It was probably late April that I came down to Langley Field [Langley Research Center, Hampton, Virginia], and started May the 3rd, either May 1st or May 3rd, because thirty-five years later I retired on May the 3rd in '94. That sticks in my mind.

It was a great experience working on what we called "the flying doorknob" at the time, after working on a plane. The Mercury capsule looked to us like a flying doorknob. We really couldn't imagine why they needed people to work on aerodynamics of a flying doorknob, but later we learned that it's not just a flying doorknob, you had a launch escape tower, you had the launch configurations, the Redstone [rocket], and the Mercury configurations, the Atlas Mercury configurations. So there was a lot of aerodynamics to be done. That was what I worked in initially.

BERGEN: How did those aerodynamic studies different from the type that you did with airplanes?

EWART: Not in how we went about obtaining the data, because you go through wind-tunnel tests, you go through free-flight model tests and full-scale model tests. In that case it was a Little Joe [rocket] off Wallops Island, and then, of course, you have the actual mission to confirm your original estimates. But the kind of coefficients you came up with were very different from a flying an airplane.

But I had been down to Langley Field back in '56. We were testing the AVRO Arrow in the Unitary wind tunnel, supersonic wind tunnel, and that was a great experience, too, six weeks. We also came down later and flew a free-flight model from Wallops Island, which is a NASA facility, and that was very successful, too.

I remember Wallops. We were put up in billets out there, and it was nice being by the oceanside and the ocean lapping the shore, but the steaks were tough and the mosquitoes were big, and we learned how to avoid the mosquitoes. Anyway, it was a good experience. So I had some experience being at Langley Field, so when I went down to the Space Task Group at Langley, it wasn't strange to me.

From there, we all moved down, as you know, to Houston in late [19]'61, early '62, and I guess I had about three months in Houston, but some of that was flying back to Langley because some of us were still back at Langley, Dick [Richard R.] Carley, for example, who ran the analog lab back at Langley, and working for him was Stan [Stanley H.] Galezowski. Stan and I worked together closely on the simulation that Stan put together for a manually guided entry of the Apollo around a rotating Earth. It was a simple manual guidance program, but the idea was to establish that it was feasible. We didn't know at the time. You have a narrow entry corridor coming back into the atmosphere at 36,000 feet per second, and there was a lot we didn't know, but my job was to fly the manual entry simulation, and I guess I flew about 140 or those entries, different angles of approach, different conditions, and it proved to be very feasible, and I think that simulation helped Rockwell, or at that time North America [Aviation, Inc.], in their initial work on similar simulations, more sophisticated.

Al [Alan B.] Kehlet, he was appointed engineering manager in the field office at Rockwell. I keep on calling it Rockwell. It's North American Aviation Space and Information Division. He was appointed engineering manager to manage the engineering side of the resident office when working on the Apollo command and service modules. Al, who had been my section chief back at Langley—a real nice guy—he asked me if I'd like to go out for a couple of years in the resident office, which sounded great to me, two years in California and working with hardware. I missed working with hardware. I'd worked at Fairey Aviation in [Hayes, Middlesex,] England on hardware and at AVRO on a lot of hardware, so it was a nice opportunity, and I grabbed it, came out here, fell in love with California and the weather and the ocean being so nearby. That was for a two-year stint, and thirty-two years later I was still here. It was an unexpected sequence of events that enabled me to stay in California.

I wouldn't have minded going back to Houston, but you get to like the place and the people and the climate, of course. That was the Apollo Program, and [why] I was able to stay out here towards the end of the Apollo Program was that Skylab was starting up, and they wanted somebody to work as a resident rep [representative] for JSC [Johnson Space Center] at McDonnell-Douglas-Huntington Beach on the orbital workshop, part of the Skylab. JSC had responsibility for the experiments and, of course, the crew interface, astronaut interface on the workshop. So that was my job as a resident rep, to keep things running smoothly for those two areas. Matter of fact, Dick [Richard H.] Truly was assigned out, not as full time, but as a frequent visitor to the orbital workshop for the crew interface, and we got to know Dick real well. He was a very nice guy.

We'd adjourn to the—I think the Jolly Roger at Seal Beach for happy hour on Fridays. That's when you get to know people. That was [19]'71, '72. I thought "For sure things are going to wrap up in California. I've got to go back to Houston," but then along came the Space Shuttle Orbiter Program, and I never thought that North American or Rockwell [International] at that time would win the contract, but they did. So they wanted me to go back to Downey and help staff the resident office there. In '73, I was chief of the Systems Engineering Office, we were helping in the design of the Space Shuttle Orbiter, working with the subsystem managers in Houston and, of course, the subsystem designers at Rockwell.

The main task of the resident office was to oversee for NASA the manufacture and acceptance testing of each Space Shuttle Orbiter and all its related hardware, the mission kits and modification kits, the ground-support equipment, and other bits and pieces like the tail cone and extended duration orbiter pallet, EDO pallet. Whatever Rockwell had to build, we had to help supervise the manufacturing and participate in the testing, review the test procedures, and approve the test results.

So part of the time I was at Palmdale [California]. The job I had at Palmdale was supervising the NASA role in the acceptance testing of Space Shuttle orbiters. So it involved staying up there for about seven months of the year during the week and occasional weekends. My guys would be on station with the Rockwell test engineers. They would, of course, review and approve the test procedures, and then as the testing progressed, they would review and approve any changes to the test procedure and any discrepancy reports that were written on discrepancies that cropped up. So that and a review of the data after the fact constituted our review process for each test. So we incrementally got a warm feeling that the orbiter was built right and was testing out okay.

The final test was the final factory test or integrated test. The crew for the first flight of that vehicle would come out to Palmdale and participate in the crew module in the test, and they'd work around the clock with us, just like other members of the team.

The last one that I was involved in was the final test of *Discovery*, and Mike [Michael J.] Smith was the factory astronaut at Palmdale at the time. We were working closely with him and the crew that were to fly *Discovery* the first time. The thing that impressed me, the thing that sticks in my mind, is how fresh Judy [Judith A.] Resnik looked after thirty-six hours of testing. She wasn't on all the time, of course, but they were working just as long on station as we were, and I was bleary-eyed at the final test, the post-test meeting, but there was Judy, bright-eyed and bushy-tailed. [Laughter] She was quite a gal. They did a great job in working with the Rockwell and NASA team, and it was all the sadder when they were killed during the *Challenger* [STS-51L] accident, sadder for many of us.

Well, then, in [19]'84, Bill Wilson, who was the resident manager, wanted a deputy, and he got [Aaron] Cohen to agree to appoint one, so he asked me to be deputy resident manager. So I was probably more at Downey [California] than at Palmdale from '84 to '85. In '85, Bill, to our surprise, decided to retire, so he wanted me to be resident manager. I thought it would be just for a few years, because we had built the last orbiter, the *Atlantis*,

and there wasn't too much more on the slate to build. But, of course, we had another tragic accident, the *Challenger* accident, in January '86.

At the time we were building structural spares. Many thought that this was a kind of unnecessary pieces of hardware to build, but it came in extremely useful because we used those structural spares. The structural spares [included] the crew module, the aft fuselage, the mid-fuselage, [wings], payload bay doors, [landing gear], that together we thought any one of those might be required if we had a forced-landing or damage to the vehicle in a hard landing, and it turned out otherwise. They were very useful as the nucleus for the *Endeavor*, the last orbiter that we finally did build.

So that kept us busy until April '91, when we rolled out the *Endeavor*, slightly under budget, $40 million, according to Rockwell, and pretty well on schedule with the fewest open items of all the delivered orbiters. Every vehicle we ship, whether it's Apollo command and service modules or Space Shuttle orbiters, when you're tied to a delivery schedule, there's always a few open items that you ship to the Cape [Canaveral, Florida], but *Endeavor* had the fewest of all the deliverable orbiters.

Then we got *Columbia* back for what they call OMDP, orbiter major down period, which constituted a very thorough physical inspection of the structure, plus making modifications to improve its stay up in orbit, or other system improvements which enhanced its performance or gave it longevity. Columbia came back and—I've forgotten how many months, probably about seven months or eight months we had working on that. Then, as you also know, they decided to use Palmdale as a major mod [modification] site, so each orbiter in the fleet comes back to Palmdale and goes through its structural inspection and any modifications that are needed.

So Palmdale has a role in life for the foreseeable future, particularly if they want to keep orbiters flying well into the twenty-first century, and there's nothing on the board that might be available before roughly 2010, so we just hope they keep them flying.

In '94, they had that incentive for people to retire in JSC, the first of several packages, and I think five of us in the resident office took that opportunity. So May '94, I retired, and I've been retired five years. So that's where we are.

BERGEN: That was a great overview. If I can go back with you to when you came to NASA, what was your impression of NASA and the people there? I know you interacted with them some. What was that work environment like?

EWART: It was a great working environment. NASA, to me, coming out of industry, was very laid-back, but one shouldn't be deceived by this casual approach. There were a lot of very capable people in NASA, and it's just a combination of the Virginian way of life, kind of a slower paced way of life, and also the different type of work that NASA was doing. It was research, to some extent development, but mainly research. They'd inherited a lot of the know-how and people from NACA [National Advisory Committee for Aeronautics]. NACA, that was their role in life, doing research, writing very good reports that helped the aerospace industry in the United States. It helped us in Canada and probably helped the Russians, too. So that was my main impression. It was a delightful place to live for most of the year. It became a little hot and humid in the summertime, but you had a measure of freedom that you certainly didn't have in industry, but you were still a part of the team, and it was a very good team.

BERGEN: In 1961 Yuri Gagarin made his first flight, made the first space flight. What impact did that have on you? What did you think about the space race between the United States and the Soviet Union?

EWART: We didn't know how far ahead the Russians were. We knew from Sputnik that they had the edge on us, but until Yuri Gagarin went into space and came back successfully, at that point we realized that they had quite a lead on where we were, but we also knew that we weren't too far behind, and it was a good incentive. It was a good stimulus to work even harder.

BERGEN: After Alan Shepard's flight, President [John F.] Kennedy announce the goal of sending a man to the Moon and returning him safely to Earth before the end of that decade. What did you think about that, and how was that for you?

EWART: Well, we thought it was great. It was a real boost, a real shot in the arm, and we felt we had support at the highest level, but also some of us thought it was a little ambitious to work out all the bugs and get to the Moon by the end of the decade, and it was quite amazing how that whole project was pulled together with upwards of 300,000 people all over the country working on it. It was quite a management achievement, apart from a technical achievement.

BERGEN: You worked on the Mercury Program for a while and then you moved directly into the Apollo Program. What were your first responsibilities as part of the Apollo Program?

EWART: Well, the first exposure to Apollo was reviewing the studies made by the various contractors in the period before the request for proposals for Apollo. We were the recipients of piles of documents. They were allowed to produce so many thousand pages, and I think they filled up every one that they were allowed to. I recall there were three major responders to the study contract, and that kept a lot of people at Space Task Group busy reviewing what they had submitted. And then, of course, this simulation I mentioned for the reentry of the

vehicle, and then the main role that I had and others had at the resident office was that of the oversight, NASA on-site oversight of the contractor in the design but mainly the building and testing of the Apollo command and service modules.

BERGEN: When you went to Downey as a NASA representative, what was the atmosphere like there? What was their state of readiness for production?

EWART: Downey was building up fairly rapidly in personnel and facilities and equipment. It was a rather rapid pace of build-up, and I guess Houston had the task of keeping a good control, a good handle, on how rapid the build-up was. It was a cost-plus-incentive contract, so the contractor had a natural incentive to—well, he had tendency to build up a little too rapidly, a little too many people, so we had a rapid build-up and then a bit of a layoff later in the program, and then it built up again. The pace was fairly intense, and the design effort was, of course, the most intense.

They had some system meetings every two weeks back in Houston where the subsystem manager would chair the meeting, the Rockwell design engineer would be there, and along with any subcontractor personnel who were working on the subsystem. We in the resident office at Downey were asked to go back and support these meetings, too, so we were back there roughly every two weeks, and you got a lot of flying in with Continental Airlines and National Airlines, but it was a very hands-on approach that NASA conducted in overseeing the design. At times Rockwell complained about—or North America at that time, about being micromanaged, but I think it was a pretty good approach. Over the years, NASA has tended to back off a little bit and give more freedom, design latitude, to the contractor, but we were all learning how to do it.

So that was the pace that we encountered at North American in the early phases, lots of hardware being built, "boiler plates" [spacecraft] to be flown at White Sands [Test

Facility, New Mexico], to be dropped at El Centro in the Salton Sea, and then … boiler plates [spacecraft] to be flown at Cape Canaveral, and then, of course, the dummy spacecraft, the unmanned spacecraft and then the manned spacecraft. So there was a lot of hardware.

BERGEN: How were you received by North American personnel as the NASA person? Maybe they might have perceived you as looking over their shoulder. Did you feel that way?

EWART: It didn't come naturally to North American, because the Air Force had not provided such close scrutiny in the programs that they had been involved in, the Navajo missile and the Hound Dog primarily at Downey. So it was a little different approach, and we had some slight problems in getting the right kind of documentation from Rockwell. For example, putting together test reports of a quality that we needed in order to document the testing and be able to assess the success of the test.

But over a period of time we got to working closely with Rockwell, and they had confidence that we were there to help, not to hinder, and this carried over into the Shuttle Program, because they had experience with us on Apollo. The [Space] Shuttle Orbiter Program was smooth sailing compared with the early part of Apollo.

BERGEN: During the Apollo Program, were there certain North American personnel that you worked closely with?

EWART: Yes, but this is where my memory starts to fail me. John McCarthy was in charge of quite a number of people, probably about up to 1,000 people, back in the early phases of Apollo, in North American Aviation, and we worked closely with him. We worked closely with others in my little element of guidance, navigation, and control, worked closely with

Bob Antletz. I really have to look at an employee list to be able to remember all the other names.

BERGEN: Did you work much with people from MIT [Massachusetts Institute of Technology] in your position?

EWART: Oh, yes. As a matter of fact, Aaron Cohen—Paul Ebersole was in charge of the guidance and navigation part of the Apollo Program, which was a large subsystem, but important subsystem designed by MIT, and later the manufacturing of the system was awarded to A.C. Electronics. We worked closely with Paul Ebersole. We worked closely with Aaron Cohen, who was the guidance and navigations, I think, subsystem manager for Apollo, and he would come out frequently to Downey, and we'd go back to the subsystem meetings back at Houston.

Honeywell had the stabilization and control system, so we would go back occasionally to Honeywell to see how that was going on in support of the subsystem manager. I can't remember who the subsystem manager was in Houston, but they were excellent people. We were really privileged to work with such a good bunch as we had.

BERGEN: In 1965, General [Samuel C.] Phillips came out with the Phillips report which was never officially published. Were you aware of it at that time?

EWART: In '65 a report on what?

BERGEN: General Sam Phillips' report?

EWART: I'm trying to think. I vaguely remember that report, but my recollection of Sam Phillips was at one of our management reviews at Downey when Dr. [Joseph F.] Shea, Joe Shea, was holding forth at the podium explaining how the program was progressing. Sam Phillips was in the audience. At the completion of Dr. Shea's pitch, General Phillips said, "Joe, you should have been on the stage. You'd have been a great actor." [Laughter] There was a certain amount of rivalry between the two. But I can't recall the report you mention.

BERGEN: When the Apollo fire occurred, you had a unique perspective because you were a NASA person at Downey. From your perspective, how did that fire affect personnel at that facility?

EWART: There was a profound effect at the facility, because, as you know, we went into almost a mode of depression about the loss of lives, and then there was the determination between NASA and Rockwell to find out what went wrong and come up with a better spacecraft. So there was a Block II version of the spacecraft that required many thousands of hours of redesign and, of course, refabrication. Frank Borman came out. I think he was resident out at Downey, working in Building 318, which was one of our satellite buildings, and overseeing [for NASA] the redesign phase of the Apollo command and service modules.

But it gave us an opportunity to take a fresh look at what had been done and come up with other design improvements, like a Block II guidance and navigation system with a better computer and other improvements, as well as rectifying any deficiencies such as in the wire routing that were considered [necessary] at the time. Matter of fact, one of the outcomes of that, I seem to recall, is that you had a strict segregation of power wiring from instrumentation wiring, and if you had redundant systems, then the wiring path had to be redundant and separate so the failure of one wire in a system would not fail the wire in a redundant system. That may have had some bearing in the—we don't know for sure—in the

[TWA] crash that occurred. There has been a thought that there may have been some wire damage in that that caused the tragedy.

Anyway, to go back to the Block II command and service module, yes, it had a dramatic effect on the command and service module program at Downey and at Houston, too.

BERGEN: Did you participate in any way in the investigation following the Apollo 1 fire?

EWART: I was asked to take part in a NASA Headquarters quality audit of how the Apollo Program was being conducted at the various contractors' and NASA Centers. It was headed by Admiral [Roderick O.] Middleton. He was Captain Middleton at the time, but he became an admiral. We, as a team, went around the main contractors, Grumman [Aircraft Engineering Corp.], Long Island, Bethpage [New York], Downey, of course, Rockwell, North American at the time. We went around IBM [International Business Machines] on the instrumentation unit at Huntsville [Alabama], and then Johnson Space Center, Kennedy Space Center, and I think we went to McDonnell-Douglas on the S-IVB. They may have gone around the S-II, but I had other work to do at the time, so I couldn't attend that. It was later lead by Will [Willis] Willoughby [Jr.].

The whole idea was to get an overview of how the quality was being designed into and inspected into the whole vehicle. But to me it was a great opportunity to see how all the other elements of the Apollo Program were being designed, fabricated, and tested.

BERGEN: When the final report of the Apollo 1 investigation came out, how did you feel about what it said about North American? Did you feel it was a fair evaluation or maybe unfair toward North American?

EWART: I'm pretty hazy about what all was said in that report. There were many factors that contributed to the tragedy that occurred on the pad, and they've been thoroughly documented. There's no doubt that just one of the factors was the susceptibility of the wiring to damage. In other words, it could have been better protected. We don't know for sure how the short circuit occurred, because it must have been a short circuit which started the fire, but that was merely one factor. The wiring could have been better routed, better protected, but there were other factors, the overconfidence in the kind of test that was run. The kind of test being run with pressure above atmospheric pressure, with 100 percent oxygen, had been successful, apparently, on earlier spacecraft. But you had the other factor of the hatch. NASA had moved away from rapidly jettisonable hatches after the Mercury landed in the ocean. I think it was—

BERGEN: Gus Grissom's flight [MR-4, *Liberty Bell 7*].

EWART: Gus Grissom's flight. Yes. And the spacecraft sank. He was lucky to get out with his life. So that was ruled out for the Apollo command module, and in a way it was a very unfortunate decision, because that could have saved their lives. Something that took ninety seconds to open was far too slow to be opened. But the policy of testing in a high-pressure, 100 percent oxygen environment was an accident waiting to happen itself. I don't know exactly what was in the report, I can't recall, but those were the main factors that contributed to the accident that I can recall.

BERGEN: You mentioned some of the test flights earlier. Did you actually participate in any of those test flights?

EWART: No. The test flights for the Apollo Program, the Big Joe flights on a General Dynamics booster were to test out the launch escape system at White Sands. We oversaw the results. We helped analyze the results of the test as far as the performance of the hardware, but, no, we didn't participate in the testing there or the drop tests at El Centro. Our main role was to oversee the fabrication of the hardware that was going into those tests and also the boilerplate tests which were flown out of the Cape. Again, our responsibility was for the fabrication and testing and delivery, hopefully on schedule. One of two of us would go down to the Cape to follow up in the receiving and initial work on the boilerplate down there, but it was not in great depth. That was the responsibility of JSC and KSC [Kennedy Space Center] and, of course, the contractors down there.

BERGEN: After the changes that were made after the fire and the Apollo 7 spacecraft was completed and ready for the mission, did you feel confident in this new spacecraft?

EWART: Yes, but bear in mind that we were all working in our specific areas, sort of specialized, limited areas at the time. We were not so involved in the design as in the fabrication and testing, but we did get to become familiar with the design changes made in the course of developing the Block II command and service modules. And, yes, we felt very confident that what we ended up, that eventually flew successfully, [were] excellent spacecraft.

BERGEN: Apollo 8 was a great triumph for NASA, for North American, and I imagine for your specific system, since it was navigation, guidance, and control. Can you share your memories of Apollo 8 with us?

EWART: Well, we were delighted when the mission for Apollo 8 was changed so that it became a circumlunar mission, because it was a bold move and a bit of a gamble, but it allowed evaluation of the guidance and navigation system in one of its most demanding roles and also to come back in at circumlunar return velocity of 36,000 feet per second. That was a great test. We had reentered—I think it was Boilerplate 20, 17 and 20, came in at or close to simulated lunar reentry speed, but this was the first time we were doing it, coming back from the Moon and with [men] inside. So, yes, it was an amazing and a most satisfying result. It was a great mission, and, of course, it had public relations impact, too.

BERGEN: Speaking of public relations impact, Apollo 11 was soon to follow. Do you remember where you were for Apollo 11?

EWART: Yes. I can't remember exactly. I was in and out of—we had a mission support room at Downey, and the role of a mission support was to support the Mission Control Center in Houston. It was in communication with the spacecraft at the Cape and also, of course, the Launch Control Center, the Mission Control Center and the vehicle, once it got into orbit or on its route around the Moon. I can't recall if I was in the mission support room for the actual landing. I really can't remember where I was, but I do remember watching on television either in the mission support room or back at home. We worked shifts in the mission support room, you know, twenty-four-hour work, and you felt you were being closely involved.

BERGEN: Did you continue to work in the mission support rooms for subsequent Apollo missions?

EWART: Either I or others were in it. We took shifts, yes, for all the Apollo missions.

BERGEN: But Apollo 12, at launch the vehicle was struck by lightning. Do you remember that?

EWART: Oh, yes. That was the first and biggest lightning test we had, and I guess there was a lot of uncertainty as to how well it would come out of it. We were all gratified to know it recovered. Incidentally, that triggered thorough—as thorough as we could—lightning tests on the Space Shuttle Program to make sure that we were anticipating a similar kind of problem.

BERGEN: The next mission was Apollo 13. What kind of mission support were you involved in for that mission?

EWART: Well, Apollo 13, it was North American who were manning the mission support room and providing help to Houston, as required for the work-arounds, but the main role in coming up [with] the work-arounds was performed by Houston, the Mission Control Center supported by the subsystem managers and the engineering division down in Houston. Rockwell participated, too, and I can't recall just exactly how. It was [mainly] in the environmental control system, in [confirming] the proposed work-arounds that Houston were coming up with: the control of the carbon dioxide partial pressure and other problems, the heating, how to keep warm enough. It was a great combined team effort, and we were just there in a support role.

One thing I should mention about Apollo 13—I think I sent you a copy—after the mission and the safe return of the crew, Grumman [builder of the lunar module] sent an invoice to North American for towing the spacecraft back to the Earth. It was nice to have that little light side to what was a near tragic affair.

BERGEN: That's true. After the Review Board investigated the Apollo 13 incident, did that cause any major changes at North American [unclear]?

EWART: No major changes. There was close scrutiny, of course, of the oxygen tank in which the wire had been damaged, so there was an investigation into the design of that and any necessary redesigns, but after the cause had been thoroughly established, that was the extent. I'm trying to think if there were any other ramifications. No, I think it was mainly control to the cryogenic system, limited to the cryogenic system.

BERGEN: Are there any other Apollo missions that stand out in your mind or any impact on you?

EWART: Well, of course, Apollo 11 was the biggest, 13 because of the near tragic accident. Alan [B.] Shepard [Jr.] hitting a golf ball on the Moon [Apollo 14], and, of course, Apollo-Soyuz, the Apollo joining up with the Soyuz spacecraft. I guess each one had its own element of thrill about it. The Apollo command and service module's docking with the Skylab and their amazing—their repair work, the canopy they put over the separated micrometeoroid shield and making it a habitable successful spacecraft. Technically, it was very interesting and fascinating.

BERGEN: For Skylab, you went to McDonnell-Douglas [Corp.] to oversee the orbital workshop.

EWART: That's right.

BERGEN: As you mentioned earlier. How was this experience different than working with North American?

EWART: McDonnell-Douglas had not worked on a manned spacecraft before. I don't think they had had the close on-site presence of NASA personnel before, looking over their shoulder. So that was a little change. There were some improvements in the way the test procedures were written, and Houston and the resident office at Downey were able to help in that respect. They hadn't worked with astronauts before. Of course, the astronauts they were working with were very smart cookies. They could ask all the questions that needed to be asked, and I think this was a learning process for McDonnell-Douglas. But we got along very well with the contractor, as we did with North American, once they realized that we were there to help, not to be a problem.

BERGEN: What were some of the milestones in this development of the orbital workshop?

EWART: Well, the first [milestone], of course, [was] the recovery from the loss of the micrometeoroid shield and then the progressively longer stays in orbit, I think the milestone was technically the relative sophistication of the spacecraft, the ability to sit at a wardroom table and heat up your food, to have a toilet which was … almost like one on Earth, to have an exercise machine you could pedal away on, and then the innovation of getting their exercise by running around the lockers at the top of the workshop. Technically it was a great step forward.

BERGEN: After Skylab, did you have some involvement in the Apollo-Soyuz mission, the docking mechanism or anything?

EWART: Not really, because—well, other than, as I say, our limited support role in the mission support room for the Apollo-Soyuz. And I say "we." It was primarily North American who were manning the mission support room, and we were there in an oversight capacity, and also I was down at McDonnell-Douglas during the time that [those] command and service modules were being made and tested at Downey. So when I came back, I think it was about to be delivered down to the Cape.

BERGEN: And then you went into the Shuttle.

EWART: [On] to the Shuttle, yes.

BERGEN: Did you work on any of the preliminary designs for Shuttle?

EWART: We followed them, and there were some study contracts that Rockwell had been working on, and again, I think I was down at McDonnell-Douglas when the study contracts were under way. By the time I came back in [19]'72, they were busy on the request for proposals, but we didn't get involved in the evaluation of those. As the design evolved after the contract award, yes, we became familiar with those in the course of the subsystem meetings, which were handled a little differently from the Apollo Program, but they still had meetings, more so at Downey than at Houston, but at both places.

BERGEN: What were some of the challenges that you ran into during the development of Shuttle?

EWART: Design was not our forte, of course. We were in kind of a remote mode, helping as we could in how the design affected the way we could test it and build it. The design

problems, as I recall, were the aerodynamics of a very swept-back delta coming in through the atmosphere and the heating of the thermal protection system [tiles]. The thermal protection system perhaps was the biggest unknown. They had the capability to test aerodynamically up to fairly high mach numbers, but there was still a gap between the highest mach number that could be tested and the mach number for entry from orbit.

So that was a big unknown, and on the command module it was an ablative thermal protection system and not reusable. In other words, you were burning off some of your protection system as you came in. This was designed to be a reusable protection system, and we weren't even sure if the tiles would stay on, or how many tiles you could lose and still come back in. I think those were the two biggest problems that I recall. Again, we were not design authority. We were just helping out.

BERGEN: What were some of the differences between working on the Apollo Program at North American and then working on Shuttle?

EWART: There was less NASA detailed involvement. They backed off a little on Shuttle, allowed the contractor a little more design freedom, but they still required fairly close scrutiny. It was just handled a little differently. They had all the management reviews, I think, once a month, and we had, of course, the design reviews, the preliminary design reviews, critical design reviews, and then the configuration acceptance reviews once you had built the vehicle, the first vehicle.

Those are very similar to how it was handled on the Apollo command and service modules, but the contract was incentivized a little differently, and we were all a little smarter in how to write the contracts, our contracts personnel, and the extent of involvement of the personnel. We were not required, for example—well, let me put it this way. On the Apollo command and service modules, they wanted almost total involvement in all the acceptance

testing, and we had support contractor personnel to help the resident NASA in participating in these tests. The test was always analyzed in real time, and afterwards I had a group of engineers to double-check all the data which was not analyzed in real time, and there was quite a lot. This was something we could afford on the Apollo command and service modules.

By the time we got to the Space Shuttle Orbiter, there was far greater dependence on the real-time data, and we took the risk of not reviewing the—additional data [which] hadn't been reviewed on real time. In other words, we settled for less than 100 percent review of data on Space Shuttle Orbiter, and it proved that this was an acceptable risk to take.

Other than that, it was handled in a similar way. We did not have so many resident NASA people on the orbiter program. That was another way in which we had backed off from micromanaging, if you will, as the contractor claimed, the program. We had learned how to become involved, how our inspection personnel should be involved on the spacecraft. We had a very large contingent of NASA inspectors on the command and service modules at Downey.

For Space Shuttle Orbiter, we decided NASA would not be in the inspection business at Downey, so we utilized the DCAS, the Defense Contract Administrative Services, personnel, [quality, and] quality engineering personnel, to perform that role both at Downey and Palmdale. They changed the name from DCAS to DC-something else, but it's another agency other than NASA.

BERGEN: In 1986, the *Challenger* accident occurred. How was the impact of the *Challenger* tragedy different from the Apollo 1 [accident]?

EWART: It was in the course of a mission rather than on the pad. It was perhaps so totally unexpected. It had, if anything, greater impact because there were more people involved. I

mentioned before that Mike Smith had been the factory astronaut at Palmdale, and so we got to know him very well. That was almost a personal loss when Mike was killed. So there was a way in which we felt that accident very deeply.

As for what happened afterwards, the search for the cause, that was very similar to the post-Apollo accident. It turned out, as you know, to be the solid rocket booster, but we didn't know at the time. We thought it might have been something that happened on the orbiter, so there was great concern until that was established as not being the cause. I guess it showed up some shortcomings in the way NASA, the big NASA, was handling the program and certain parts of the program, but that's all been totally recorded and analyzed.

BERGEN: What were some of the activities that took place at Downey between the time of the *Challenger* accident and the return-to-flight mission?

EWART: As I mentioned, there was this very deeply—this review of anything that could have possibly contributed to the accident on the part of the orbiter, and Rockwell was heavily involved with JSC in that, but, to my knowledge, Rockwell was in a support mode for the return to flight after all the corrections had been made to the SRB. Because of the fact that this was a qualification test of the O-ring that had not [been] surfaced up to upper-level management as to the constraints imposed by the qual [qualification] test on the mission, it did have some effect on people taking a second look at how the information was conveyed in our part of the program. So there was a healthy second look at how we were doing things, but it turned out that we were doing it okay.

BERGEN: Over the years that you spent at North American-Rockwell as NASA's representative, what type of change did you see over that period of time in the relationship between North American, Rockwell, and NASA?

EWART: Not really very much, but that may be because of how closely involved I'd been—[and] it's a long period of time, like the thirty-two years that I've been more or less at Rockwell, except for the nearly two years at McDonnell-Douglas. I think both Rockwell and NASA came to have a healthy respect for each other, confidence in what each was doing, and a better understanding of our respective roles. We all got smarter in how to implement the contracts, how to improve how you tested, how you improved inspection, how you got better value out of your contract, in other words.

You backed off where you could from close inspection, even in the contractor. They place more responsibility on the individual doing the job rather than relying on inspection uncovering any defects. In other words, you design quality and you build quality into a spacecraft; you can't inspect it in, because in some respects you just cannot inspect what has been done. Once you've closed out an area, it's closed out. So we all got smarter in how to better design, better build, better test, better inspect the hardware and how to write contracts to get the most for your money.

BERGEN: What is your overall view of the Space Shuttle?

EWART: Of the Space Shuttle? Well, I think it's an fantastic machine. It's an extremely complex machine, and we would have to, for various reasons like reviewing a discrepancy or for other reasons, go through the aft fuselage, and when that was fully built, it was like a jungle gym. It was very difficult to move around, and you had to be very careful not to step on the wrong thing and damage any hardware, but it gave you another slant on the complexity of the vehicle.

It was amazing to me that this thing could fly and perform so reliably, being so complex. The miles of wiring, the miles of tubing, and, of course, the thousands of tiles that

go on the vehicle, it, of course, did not live up to the expectation or the claim that NASA may have made about the cost to put a pound into orbit, but it has proved invaluable for repairing satellites which are in close enough to the orbit of the Shuttle to be repairable. And I think it served, to some extent, the similar function that Apollo did in being something the country as a whole could be proud of. But obviously we, NASA, and the contractors can build a better widget, a better Space Shuttle, build it smaller, cheaper, and able to put payloads into space for less.

BERGEN: Did you have an involvement in the building of the docking mechanism for Shuttle-Mir?

EWART: No. The latter part of the time I was in the resident office, we were testing out the Russian docking mechanism with the docking module that NASA and Rockwell designed and put together, and we had some Russians who were working with us on that. So it was from a fabrication—overseeing the fabrication of it and the testing and the mated testing that we got involved in. That was the extent.

BERGEN: As you look over your career, you've basically been involved in the space industry since the beginning. What do you consider your most significant accomplishment?

EWART: Well, just making it this far, staying alive. No, I'd like to think that, again, it's not just myself, it's as a member of the team, as a member of the acceptance and check-out team, Rockwell-NASA, helping to produce or confirm the satisfactory production of all the orbiters, the *Enterprise* and the five space orbiters. I think that was the biggest contribution that I and the rest of the team had.

BERGEN: What do you feel was your greatest challenge during your career?

EWART: Well, I'm not sure I can pin down any one challenge. In a resident office, you have to be adaptable. You move around. I came out first, as I mentioned, as the resident engineer for guidance, navigation, and control, and then you have to fill the roles that they want you to fill as time changes. For a while I was heading up a quality engineering office, test planning and analysis office, and then systems engineering office. Each one was a little challenge in itself, but I honestly can't say that any one was bigger than the rest.

BERGEN: Having seen so much of the progress in space, what do you see for the future of space?

EWART: I think it certainly has a significant future. There's no backing off from participating in space exploration. I think a lot more because of the technological advances that we've already seen with that little robot [Sojourner] on the planet Mars, there's going to be perhaps more advancement in unmanned mission than there are in manned missions.

But the Space Station has a definite role to perform. If nothing else, it's this wonderful achievement of cooperation between umpteen nations to help design, to build, and to man it. It will be many years before we get a manned mission to Mars, but I think that's inevitable in the long run. We just have to become maybe a lot smarter in how to build vehicles, manned vehicles, [to] go there, and come back. But it's not beyond the realm of possibility.

BERGEN: That basically covers most of my questions. Is there anything that I've left out that you would like to talk about?

EWART: Well, when you talk to John [D.] Hodge, you might remind him of the time that he put together a cricket team. The group that came down from Canada were half native Canadians and roughly half British ex-patriots. So he put together a cricket team of those of us that came from Britain originally. We played the College of William and Mary on the town green at Williamsburg [Virginia]. That was a memorable day. Even if we did get beaten, it was a nice way of enjoying the environment, you know, the laid-back, simulated colonial town of Williamsburg, and afterwards we adjourned to a steak dinner at, I think, Channing's Tavern. I have a soft spot for Williamsburg. It's one of the places I'd like to go back and revisit.

BERGEN: It's a beautiful place.

Before we close, I'll see if Rebecca or Carol had any questions.

WRIGHT: I have one. Talking about your early days, when you went to work for AVRO, what did you set for your expectations when you went there? What did you want to be?

EWART: Well, I was in aerodynamics at AVRO. I guess I could have gone on to structures or something else, but I'd always been interested in aerodynamics. I'd been in the wind tunnel, helped run wind-tunnel tests at Fairey Aviation in England. So that was a natural thing to do.

Impressions. It was a wonderful life in Canada, although the weather was a lot colder than England. I arrived in November, and they had an early snow. So that was my first impression, traveling to work in a car, but a heated car. Not too many cars in England at the time had heaters in them. Skidding around on snow, and I wondered how difficult it would be to travel to work. It was about fifteen miles to where I was working, in a typical Canadian winter. But they plow the streets pretty effectively. It was a very ambitious project, the

AVRO Arrow. As I say, it was way ahead of its time in many respects, and it had a lot of potential for defending the North American continent, or helping defend.

But the other attraction of going to Canada was, they had an auxiliary squadron, which is an active reserve Air Force squadron. We'd had agreements with the rest of the Commonwealth in Britain, Australia, New Zealand, South Africa, and we could [have] exchange postings. If you got your wings in the RAF [Royal Air Force], you could get transferred to an auxiliary squadron in Canada or Australia if they had an opening, and they had an opening in … [400] Squadron in Toronto. So that was really the other attraction of going to Canada, flying in … [400] Squadron and working for AVRO. But it was a fantastic five years.

WRIGHT: So at the time that you joined, you planned to stay at AVRO, have a career there?

EWART: I planned to stay, and I had some weird notion, as youngsters do, of staying a while but then moving on and going to Australia and being in an auxiliary squadron there, and maybe South Africa. My goals were a little pie-in-the-sky at that time, but things worked out differently and, it turns out, for the better. [Tape interruption.]

BUTLER: To tie in with what Rebecca was just talking about and you moving into AVRO and you said at the time you had goals of maybe going on to Australia or South Africa, yet in the end you went off in a completely different direction. Did you ever imagine that you could become involved with the space program or going to the Moon?

EWART: No way. [Laughter] You get involved in what you're doing, and aircraft was my thing at that time. I just hadn't a concept for space. We didn't know at the time how useful spacecraft could be, satellites or manned spacecraft. No. It was quite a surprise, and it

wouldn't have been my first choice. If I'd had the opportunity to stay and work at AVRO, that would have been my first preference, but we didn't have any choice, and I'm very happy that we didn't have any choice. It worked out for the best.

BUTLER: It did work out well.

EWART: Oh, yes.

BUTLER: Throughout the time that you were working with basically the Apollo Program, were you aware of the pressures or the activities, I guess, that was going on with the Soviet Union? Was it a race to you?

EWART: Oh, yes. We were kept informed as well as one can be through magazines like *Aviation Week*, and even NASA kept us informed as best we knew, but our intelligence wasn't that good of what really was happening in Russia. So we didn't know the problems they were having in getting a launch vehicle that could safely get them up and to the Moon. So, as far as we were concerned, it was quite a race, yes.

BUTLER: Here you were racing them for a large portion of your career with NASA, and then yet later, even though you didn't work directly on it, you saw Apollo-Soyuz come, and then even later you saw the work with the Shuttle-Mir Program and us docking with them. So relations certainly changed over time. Again, would you have imagined, while you were working on the Apollo Program, that someone who was our competitor so severely at one point would then be a partner later?

EWART: No, we certainly didn't. That's why Apollo-Soyuz was such a surprise, and a pleasant surprise, that at a high governmental level they had agreed to that cooperative venture. I think it was a very needed step in the right direction to get over our fears and concern about each other. But working with the Soviets, I personally didn't get involved too much, but it wasn't, even on the Shuttle-Mir Program and the docking system, and in the International Space Station it has not been easy, I understand, for NASA. I know the Rockwell people that I knew who had gone over to Moscow and worked with the Russians, they had various problems in working with a different type of space agency and with contractors who were more used to working on highly secret missile programs, and even some of the components, like the pyrotechnics, I believe, used on the Russian side of the docking system came out of missile programs. So there was a job getting sufficient data that NASA and Rockwell could be assured that they were going to work once we were docked to them and how we could separate from them. In other words, there are different policies and standards between the two countries in degree of safety, in degree of back-up. It's a learning process, but, nevertheless, they are capable of doing some very good work. The docking mechanism that we did get to test was a quality piece of hardware.

Getting back to talking about the Russians, it was the greatest form of flattery of the NASA design of the Space Shuttle to find that the Russians had come up with a Space Shuttle that looked very similar. So that was a nice warm feeling, that at least they were thinking along the same lines, if you give them the credit, or else they considered that we had come up with a good design inasmuch as they may have copied it. We don't know.

BUTLER: Looking at a little bit with your work with Skylab, Skylab was quite a different program for NASA, since up until then they'd just been doing like the Apollo or Mercury or Gemini, sending people up briefly and coming back. Skylab was long duration and a space station of sorts. In our research, we found there's been discussion on making Skylab—the

atmosphere, painting it and making it comfortable for the astronauts. Were you involved in any of those discussions on the human aspects, I guess, to make it livable?

EWART: Not really. I didn't get involved with the design. We were more concerned in the assessment, or the astronauts' assessment particularly, of the features which would concern the most, like I mentioned the ability to exercise and the toilet facilities and the cleats that they wore in order to stay secured to the grid work, which is the flooring, and the kind of foods that they were going to be eating. I think they were tickled with the luxury afforded by Skylab compared with even Apollo, and definitely by comparison to Gemini and Mercury. But we didn't get involved in the—at least I didn't get involved in the design features, but just in NASA's assessment of how adequate they were.

BUTLER: Looking at the Apollo Program, they were so focused on getting to the Moon and getting to Moon by the end of the decade, that I know it took a lot of time and concentrated effort and many hours. Were you aware also of the other events going on around in the country? Did those affect your work at all, Vietnam and the Civil Rights Movement and—

EWART: We were, like any other citizen, interested in what was going on, but you tend to get tunnel vision in the aerospace program or parts of it, and it didn't affect us in any way. I can't really—no, can't really say it did. It was a topic of conversation, sometimes a heated topic of conversation, but you could separate out what was going on in the other parts of the world and the country from your work.

BUTLER: Summer asked you about the most significant moments and the most challenging, but is there a most memorable time for you, even just a little event? You mentioned the

cricket match. Is there some event or a couple of events, even, that stick out in your mind from the time you were with NASA?

EWART: One comes to mind. It was after I left NASA. The Canadian Space Society (CSS)—I've forgotten the true name—but there was an international space development conference in Toronto in May of [1994], and they invited all the, as they called them, NASA Canadians, that had gone down from primarily AVRO to work for NASA in '59. I think about twelve of us turned up, and we were recognized at a banquet during the conference, which was a nice touch. But it was an opportunity to meet some of the other folk—we'd all gone our separate ways—[and] to participate in a question-and-answer session on the stage at one time, and it was a nice little vacation for us.

BUTLER: Have you been able to have any other similar reunions since then?

EWART: Well, locally we have a get-together of the retired NASA personnel from Downey and Palmdale, and, as a matter of fact, we have another one coming up in May, and there is a gathering of all the Rockwell—well, now they're Boeing, they were North American, then Rockwell, now they're Boeing personnel. [The] Boeing Management Association at Downey, … invited all the present employees and retired employees and present and retired NASA resident personnel, to a dinner in the design engineering—design engineering—anyhow, DEI room. It's the one where they have the big Shuttle mock-up and the Apollo 14 command module at Downey. There's plenty of space for an audience at a meeting or a dinner, and they're going to have a dinner there on March 18th. They think it's going to be the last get-together to review the seventy years of Downey's existence before it's closed at the end of the year. Boeing is moving all their personnel from Downey to other facilities, Seal Beach, McDonnell-Douglas, what was McDonnell-Douglas-Huntington Beach, is now

Boeing-Huntington Beach, and maybe to Anaheim, wherever, but they are moving out of the Downey facilities, so it's the end of quite a historic seventy years.

BUTLER: While it will be good to be there, I'm sure it will also be hard to see that come to an end.

EWART: Yes, yes, it really will. It served its purpose, and we still have Palmdale still going. That's run by the United Space Alliance [USA], which is a combination of Boeing and Lockheed. If anything needs to be remanufactured for the Shuttle Orbiter, it'll be done in Palmdale. Now, there will be an engineering support for the missions, and, as I say, they will be moved out of Downey, but I'm not sure where they'll move to, probably going down to Huntington Beach. I know that's where Ed Vonusa, who took over from me when I left, he'll be moving down there after Downey's closed. But it's been a great life for the city of Downey and the people who worked there.

BUTLER: Along those lines, there has been a lot of merging of the companies, the aerospace companies. Like you mentioned, Boeing is now composed of so many. Do you have any thoughts on that, how that can affect the future of the space program?

EWART: Well, my emotions are, it's sad to see changes, but changes have happened over the years. You go back to the early automobile manufacturers. There were lots of them, and then they consolidated and merged or just went out of business. It seems to be inevitable in the field of technology that bigger is better as long as you stay efficient. Boeing is going to be our only source of commercial airplanes, big commercial airplanes, and AirBus [Industrie] is the only European source of commercial airplanes. They're it. It's sad, but it seems to be

inevitable. And consolidation, as long as it's done efficiently, can keep us a step ahead of the next guy. It's a global economy now, and you have to do that.

BUTLER: Somewhat along similar lines, the USA [United Space Alliance, Boeing and Lockheed] has taken on a new role with the Space Shuttle. Do you have any views on that and how that affects the way things run? Is that a good way, a bad way?

EWART: It can be a good way to do things, providing your personnel are well trained. It's another form of NASA backing off a little bit from the close involvement which is their historical way of operating, but I think Boeing (and initially … Rockwell) and Lockheed, they pooled their experienced personnel. It was a good utilization of both companies' trained personnel, and I think it could be—I think it's a good move.

BUTLER: Well, hopefully we'll see that continue well into the future.

EWART: We hope so.

WRIGHT: Mr. Ewart, those early days of NASA, things were going so fast and moving ahead so forward to get so much accomplished, one of the common threads that we've heard from people like you is that teamwork is what made it happen. Do you agree with that?

EWART: You bet. Oh, yes. That's why it's so essential to achieve a level of confidence in both contractor and NASA, contractors, subcontractors, and NASA, that mutual trust and respect and understanding of each one's roles. When you get a team made up of those kind of people with those kind of attitudes, you're pretty likely to succeed.

BERGEN: We thank you so much for sharing with us. We really enjoyed it.

EWART: It's very nice to have you folk here and shoot the breeze.

BERGEN: Now that you've retired officially, are you still active, other than going to dinners [unclear] team members?

EWART: They told me, before I retired, that once you retire, you wonder how you got things done when you were working, because when you retire it takes just about the same amount of time to—you know. For a while I was working on a couple of little desert houses, houses in the desert that my wife has. First of all, repairing them after renters wreck them and then putting them in shape to sell. That's been a nice little sideline that keeps one active.

I did a little to help the neighbor who had a temporary hire operation. I sold, of all things, computer software at a Price Cosco for a couple of months, and that was a nice experience in the retail business, but I decided that standing all day was not for me. It gets to my ancient back, particularly if you're standing—[and] they put software tables right by the entrance, and particularly in November and December it gets a little breezy. It was a nice experience, but, as I say, I don't plan to repeat it.

Sally and I might—we read where they needed [movie] extras for TV and film movies, and there's a little office in Irvine where they recruit people for that role. The pay is pathetic, but we thought that might be a good thing to keep us out of mischief.

But the immediate problem I have is, I had some eye problems, a detached retina which kept detaching in the left eye, and I have to go in for another operation on Monday to have the lens put back in. They'd operated so many times on the left eye that the lens fogged up, so they took the lens out. Now I'm going back Monday, and they're going to put another one back in, like a cataract operation. And then after that, they have to take out the silicone

gel they put in the eyeball, and maybe I'll be able to see out of it again. So I'd like to get that in good shape before we go charging around as movie extras.

BERGEN: That's right, start your new career.

WRIGHT: That sounds like it would be fascinating to do.

[End of interview]