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Dr. Mark T. Lewellyn Interview (MORS)

Lewellyn, Mark T.

Military Operations Research Society (MORS)

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Military Operations Research Society (MORS) Oral History Project Interview of Dr. Mark T. Lewellyn

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INTRODUCTION

Oral Histories represent the recollections and opinions of the person interviewed, and not the official position of MORS. Omissions and errors in fact are corrected when possible, but every effort is made to present the interviewee's own words.

Dr. Mark T. Lewellyn had a 34-year career (1977 – 2011) with The CNA Corporation, working primarily on projects in the Center for Naval Analyses, the Department of the Navy's Federally Funded Research and Development Center (FFRDC). Dr. Lewellyn retired as Head of the National Security Analysis Department at the Johns Hopkins University Applied Physics Lab (JHU/APL) in 2018, where he had worked since 2011.

Mark was a key panelist at the 82nd MORS Symposium (MORSS) Heritage Session in June 2014 focused on "Early Navy and Marine Operations Research" and at the 90th MORSS Heritage Session in June 2022 focused on "The History of Operations Research in the United States Marine Corps."

The interview was conducted via Zoom on August 9, 2022.

MORS ORAL HISTORY

Interview with Dr. Mark T. Lewellyn

Dr. George Akst, FS, and Dr. Bob Sheldon, FS, Interviewers

Bob Sheldon: This is August 9, 2022, and we're here for a MORS oral history interview with Mark Lewellyn. Full disclosure. I know from your bio that you and I both lived in Minnesota early on, including the Minneapolis-St. Paul area. So I'll be interested in your Midwest upbringing. We both endured those harsh Minnesota winters.

Mark Lewellyn: You betcha. In fact, I remember in February of 1972, the warmest it got in my hometown was 12 below zero.

Bob Sheldon: Please give us your parents' names and tell us where you were born and raised.

Mark Lewellyn:

My mother's name was Margaret Geraldine (Sandy was her maiden name) Lewellyn. She grew up in a section of West Des Moines, Iowa called Valley Junction, when she was a young girl in the 1920s. My dad lived in the same town. His name was Marvin. He always went by his nickname "Barney" Lewellyn, because he wore glasses as a kid, and they called him Barney Google with the goo-goo-googly eyes. I was born in Rapid City, South Dakota in 1950. My father was a football coach there at the South Dakota School of Mines, where he had an undefeated season in 1951. I was always the son of a father who worked for colleges, because he wanted to coach football at the college level, so we always lived in college towns. Sometimes small towns. Rapid City was probably 80,000 folks. He went from there to Wayne, Nebraska and taught at the state college in Wayne, Nebraska. He had a few winning seasons there and was named Nebraska state coach of the year by the Omaha World-Herald newspaper in 1953 or 1954, I think it was. From there, we moved to Mankato, Minnesota (about 80 miles southwest of Minneapolis) where he taught at the State University there for the balance of his career more or less. All through the 1950s and 60s and early 70s. In addition to coaching, he taught undergraduate courses in health and physical education.

My father was an interesting fellow. He was a college graduate when World War II (WWII) started. His father was a brakeman for the Rock Island Railroad and was a proud labor union member. My dad refused to become an officer, because he didn't want to be part of the ruling class, so to speak. So he was assigned as a Navy medical corpsman. He served with the 1st Marine Division in some of their campaigns. Peleliu, most notably, which clearly marked him for most of his life on what his attitudes about war and conflict were. He was a corpsman. He saw the worst side of combat in terms of taking care of wounded Marines.

One story I always tell about my dad - I was worried about something in high school, some test. He noticed I was concerned, and he said, "What's bothering you, Mark?" I said, "I'm scared about this test." He said, "Son, let me tell you what scared is. Scared is being in the second wave at Peleliu and learning there were 80% casualties in the first wave." So that always marked me in my approach to life, that as tough as things might seem to me, it was never as bad as Marines in combat in a situation like an opposed landing in WWII. So I thought it was interesting that I ended up working in naval analysis for a good part of my career, dealing with Marines and sailors who would have to be involved in issues like he was involved with when he was a young man.

Bob Sheldon: You mentioned that your dad coached football at the School of Mines in Rapid City, South Dakota. My older brother went there and studied chemical engineering.

Mark Lewellyn: I was back there in August 2011. The campus is quite a bit bigger now. My father died in 2010, and one of his wishes was for his ashes to be scattered on every football field he ever coached on.

Bob Sheldon: Did you accomplish that mission?

Mark Lewellyn: We accomplished that mission. That was part of my reason for going to Rapid City was to put some of his ashes on the field at the School of Mines.

Bob Sheldon: Tell us about your mom.

Mark Lewellyn: My mom always wanted to be an educated woman. She grew up in a family where there wasn't that much money. I think she had two years of college under her belt when the war started. She went to work for the phone company in Des Moines, Iowa during WWII. She married my dad in March of 1945. After that, my dad was very conservative; and he would not allow her to work. He was insistent that he had to earn all the money for the family, which was a challenging thing as we grew up, given that he was only an instructor or an associate professor for most of his career in state colleges in Minnesota, which had decent pensions, but not very good pay. So we always struggled a bit as children.

My mother was an avid reader. That was probably the one thing she left me with, is my recollection of her always being at the breakfast table in the morning reading a book as I went off to school. She continued that throughout her life. She was very active in an organization called P.E.O. Sisterhood (Philanthropic Educational Organization), which was big in the Midwest. It was a women's group that supported women's education and women's college, in particular. My mother was always very avid about the need for young women to be able to go to college. I always thank her for her love of reading and education that she passed on to me.

Bob Sheldon: Where did you go to elementary school, junior high, and high school?

Mark Lewellyn: I started my elementary education – kindergarten, first, and second grade - at the Hahn elementary school in Wayne, Nebraska. It was a campus school. I remember my schooling was always having lots of student teachers in the class. One master teacher, but

always lots of student teachers, which was probably good for a young kid to always have plenty of support around him in the classroom. I loved kindergarten. I loved first grade. My second grade teacher was very stern and strict. It was my first encounter with a teacher who wasn't all that much fun. But then in third grade, we moved to Mankato, Minnesota where my dad got a job coaching there after he left Wayne. I had all the remainder of my entire K through 12 education in Mankato, Minnesota, which was a town of 20,000 to 30,000 folks. They had a big state college, so a lot of the people in town worked for the college. It was focused on education, and I had a very good education at Mankato up through my graduation from high school in 1968.

Bob Sheldon:

When you were in junior high and high school, what were your favorite subjects? Did you have any extracurricular activities?

Mark Lewellyn:

I loved math and science - no surprise. Chemistry, in particular, was my favorite subject, probably because I had a very good teacher in high school - Mr. Hertzberg. That was exciting, and math was always interesting too. I enjoyed math, especially in 10th grade, where we got into big geometric proofs. I remember a theorem called Desargues' theorem that we were asked to prove. I spent all weekend working on a proof of Desargues' theorem. I can't remember what it was. George might. But I remember that I was the only one in the class that figured out the proof of it on my own that weekend. This was, of course, in the days before the Internet, where you could probably look up proofs of it online.

My extracurricular activities: I was in wrestling in the winter sports and football in the fall sports, which was sort of pro forma for young men growing up in high schools in Minnesota. Wrestling was very big in the winter there, as was hockey. Basketball was sort of a second level sport after wrestling and hockey. Hockey was tough in those days, because it was played exclusively outside – there were no indoor arenas when I was growing up, at least not in my town. But I had a good time in high school. I had good friends. I think I got a really good education, thanks largely to the taxpayers in Mankato who paid for the good schools I went to.

Bob Sheldon:

What position did you play in football, and what weight class did you wrestle?

Mark Lewellyn:

I played right guard on the offensive line on the football team. I was very proud of that, because my father had been a guard when he played in college at the University of Northern Iowa in Cedar

Falls, Iowa. In wrestling, I wrestled at 138 pounds. I was never quite good enough to make the “A” team (varsity); I was on the “B” squad. Of course, the A teams won all of the state championships. But it was interesting, and I enjoyed it.

Bob Sheldon: You played football. Did you watch your dad's football games when he was coaching?

Mark Lewellyn: Yes, I did. It was a requirement to go to his football games on Saturday nights when they were at home. I still remember the nip in the fall air in Minnesota, and I still remember a smell I loved - it was the smell of pipe smoke in the stands. Guys would smoke their pipes in the stands watching the football games. I always thought that was just a wonderful smell - the fall air and pipe smoke at a football game.

Bob Sheldon: Was there anything distinguishing you saw on your dad's coaching style of football teams?

Mark Lewellyn: One thing he told me about that always stuck with me was the frustrations of coaching. I saw that at a couple of levels. I remember after he would lose a game, I could hear him pacing all night upstairs. I had a basement bedroom, and if he lost, he'd be up all night, I think probably reliving the game in his mind. And, of course, even in those days at Division II college football like he coached in, there were consequences to bad seasons: you lost your job. So I think there was quite a bit of pressure. He was an assistant coach when he was in Minnesota. Usually it was the head coach who lost the job if they had bad seasons, one after another. But I always remember the fact that you could be graded so deliberately on the performance of your job – win or lose.

That stuck with me as I became a manager myself later on. We worried about performance reviews and evaluations. I always kept in mind the fact that my dad grew up in an environment with a much stricter assessment of performance. He also told me a story once about when they were having a tough year. He was the coach of the defensive team at the time. And the team, probably South Dakota State, was running against them, and South Dakota State had a very successful play where they went for about 40 yards and scored a touchdown. So the next time his team was on the field, he told the defensive captain to watch out for the same play going to the other side. And sure enough, the first play of the second half on offense for the other team, they tried the same play to the other side, and they scored another 40-yard touchdown. The captain came off the field, and my dad said, “Did you tell them?” He said,

“No, coach. I forgot.” Sort of the frustrations of coaching at the college level. As a coach, knowing what to do and telling the captain to do it, and then not having the captain convey your orders, always made me think about what it must be like to command a small unit in the Marine Corps or a department on a Navy ship. Having people working for you, who you have to trust to carry out your orders or your request, and never knowing for sure whether they would or not.

Bob Sheldon: Did you play any musical instruments?

Mark Lewellyn: No. I loved music, but I had no musical talents. My father and mother had hated music lessons when they were in high school and swore they'd never put their kids through it. So they never allowed me or my two sisters to study any musical instruments when we were in junior high or high school.

Bob Sheldon: How did you choose your college?

Mark Lewellyn: I focused pretty much just in-state, as a lot of kids did in those days. Minnesota had a wealth of very good private four-year church affiliated colleges. Macalester was Presbyterian. Hamline University, where I went, was Methodist. St. Thomas was Catholic. St. John's, which had a great football team, was Catholic. There was Concordia in Moorhead, Augsburg in Minneapolis, and St. Olaf in Northfield, Minnesota, which were Lutheran. Carlton, also in Northfield, was Congregational. They were all good schools. I was very keen on Hamline because I was taken there by the minister of our church. I was raised as a Methodist, and we went up to Hamline for a visit with a bunch of other kids he was trying to get interested in going there. I really had a good visit to Hamline, so that's where I decided I wanted to go. They had a great thing then called guaranteed tuition. Private school tuition was higher, of course, than state college tuition. I recall the cost for a year at Hamline was \$1,500 in those days for tuition. And guaranteed tuition worked like this: the first year, you paid \$1,650; the next two years, you paid \$1,500; and the last year, you paid \$1,250. So if you signed up for guaranteed tuition, and you made it all the way, you had less of a bill to pay for your last year. I was fortunate and got a scholarship for my second, third, and fourth years and pretty much had my tuition paid for. So all I had to do on my summer job was earn enough money to pay for room and board during the year. That was how I handled it when I was at Hamline from 1968 to 1972.

Bob Sheldon: What was your major at Hamline?

Mark Lewellyn: Chemistry. I was always loved chemistry in high school. I always knew I wanted to go into chemistry, and I knew I wanted to go to graduate school afterwards and get a doctorate in chemistry.

Bob Sheldon: Were there any professors from Hamline that you thought were really outstanding?

Mark Lewellyn: Yes. There was one guy named Olaf Runquist. He was an organic chemistry professor. I always remember him. I went to see him when I was a sophomore for some reason. I said, "All your office hours are filled up, Professor Runquist. When can I see you?" He said, "What are you doing at 5:30 tomorrow morning?" I said, "Sleeping." He said, "I can see you at 5:30." And I said, "Okay." I was convinced I was going to do it. And I remember showing up at his office at 5:30 in the morning, just as he was coming in. He rode a bike to work, and he was bringing his bike up to his office, and I ran into him. He laughed and said, "I didn't think you were going to make it." So I had my meeting with him. It reminded me later on of a couple admirals that we worked with. I think Dave Oliver was one who always said, "If it's important, you'll be interested to see me at five in the morning, so let's meet at five in the morning and we'll talk about it. If you think it's that important, I can see you then." We had a lot of meetings with Admiral Oliver at five in the morning in his office.

Bob Sheldon: Are there any other professors from Hamline you want to mention?

Mark Lewellyn: Runquist was the most memorable. I remember another guy - I took philosophy of science from him. He was named Ken Haas. He later left education and went to work for the CIA. He was the Beirut station chief when the embassy was bombed, and he was killed in the embassy bombing. I found out when I went on my first visit to CIA headquarters. Ken Haas was one of the stars on the wall with no name on it, because he was an unacknowledged CIA operative in Beirut. But if you ever saw the movie *Charlie Wilson's War*, he was mentioned in there. Remember Gust Avrakotos, the Greek American guy who worked with Charlie Wilson on providing the weapons to the Afghan rebels? Gust Avrakotos said that Ken Haas was the best man he ever knew. I thought that was interesting. I always thought that Ken Haas was a great teacher and admired the fact that he went on after I was gone from Hamline and pursued another career - I wouldn't say parallel to mine - but he also got out of academia and went into government service. I always thought that was interesting.

Bob Sheldon: Did you do anything interesting around Minneapolis-St. Paul while you're going to Hamline?

Mark Lewellyn: Not really. I basically kept my nose to the grindstone and studied and did the best I could. I went to a lot of concerts. When I was there, the Minnesota orchestra used to play concerts in both St. Paul and Minneapolis. The St. Paul concerts were at St. Catherine College (now a University), which was near Hamline. St. Catherine had a great facility called O'Shaughnessy auditorium where the Minnesota orchestra played. We used to go there and get student rush tickets for like one buck to see the orchestra play. There would always be unsold tickets, and sometimes they'd be the best seats in the house that were too expensive for people to buy, and we'd get first row orchestra seats sometimes to listen to the orchestra play.

Bob Sheldon: The Guthrie Theater in Minneapolis also used to have student rates for tickets they had left over.

Mark Lewellyn: Right. I went to the Guthrie a few times, but mostly the orchestra was what I went to.

Bob Sheldon: How did you choose your graduate school after Hamline?

Mark Lewellyn: I applied to lots of opportunities, including the one I got, which was a Fulbright scholarship to go to England. I also looked at universities. I applied to Harvard, MIT, and the University of California, Berkeley (UC Berkeley), and my sure thing was Northwestern. I remember going into Harvard, and you had to do an application process to get an application; and I said, "Forget Harvard." So I did MIT and Berkeley and Northwestern. I got into Northwestern and Berkeley, but not MIT. So I went to Berkeley. But it got delayed for a year, because I was awarded the Fulbright student grant to study in England for a year, which was what I did after college.

Bob Sheldon: Tell us about your Fulbright scholarship, where you went, and what you studied.

Mark Lewellyn: I went to the University of East Anglia, which was one of the so-called plate glass universities. It was built after WWII. It was a science and technology school primarily, built on the science department of Cambridge University, so a lot of the professors came from Cambridge to go to East Anglia. It was in Norwich, which most people in the United States would pronounce *Nor-Witch*, but people there pronounce it *Nor-Itch*. Norwich is about

90 miles north of London. I did a degree in what was called chemical spectroscopy at the time. There was a professor named Robin Harris who I'd run into when I was an undergraduate. We used one of his books as a textbook. He wrote a book on nuclear magnetic resonance, which is a form of spectroscopy that chemists use to explore molecular structure.

I met some great people and found out how hard universities are in Europe compared to the United States. The United States has continual assessment, which means you get tests pretty much all the time. In England, they have an exam system that filters people out beginning in high school. You have your A levels and your O levels, and you've got to score very well on those to even have a chance of getting into university. Then, once you get into university, it's also a very hard exam system. Typically, you have one exam for your whole three years. It's your last year, so you're tested on your whole three years in one exam. So there's lots of pressure. Then, depending on how you do as an undergraduate determines whether you get into graduate school or not. The people I went to graduate school with in England had all been through the wringer already. So it was highly selective, and I thought they were all a heck of a lot smarter than I was. But I had a good time with them, and it was just a different environment to work in.

I remember one of the interesting things about studying in Europe, both in England and Germany, where I did some work as well, was the fact that you could go in and say that you'd been taught as a kid in school that the United States has the greatest political system in the world, and they would go, "You're crazy. It's a stupid system! Without a parliamentary system, you never get anything done when the President and the Congress are in different parties. It's just stupid!" I was shocked that people would think that way. It opened my eyes to seeing their different views of how things should be done, depending on how you were raised and what sort of system you grew up in.

Bob Sheldon:

The East Anglia area is home to several Air Force bases as well.

Mark Lewellyn:

Yes, absolutely. This was before President Reagan and the mid-range ballistic missile issues. And security in Europe before Margaret Thatcher. It was when Edward Heath was Prime Minister. I was there, luckily, before the winter when they had all the coal strikes and power cuts. If you ever watched *The Crown*, about the Heath regime, even Buckingham Palace had to do without electric power during the following year. I was there from

1972 to 1973. I left in August of 1973, and the following winter they had all the coal strikes and were without power. I was there for a good winter - the winter of 1972-1973. The only bad thing about that winter was the Christmas bombings in Vietnam, and to be an American in Europe at that time was not a pleasant experience, because of the reaction of the Europeans to the Christmas bombings of North Vietnam.

Bob Sheldon: Did you get a degree from that program?

Mark Lewellyn: Yes. I got a Master of Science in chemical spectroscopy. It was a thesis program. I had to do a thesis and defend it. The whole thing about the Fulbright was that I had to write a proposal for a graduate program. The student grants were for graduate programs. You had to write a proposal about what you wanted to do, and then get a professor in the country you were interested, in my case England, to sponsor you. And then the Fulbright program would pay for the work. So it's advantageous to the university to sponsor Fulbright students, because they get money from the United States to fund the research. That's the way it worked.

Bob Sheldon: Did your research involve a lot of lab work or a lot of theoretical work?

Mark Lewellyn: Lots of lab work. I was always a lab guy. You had to know theory to form your experiments, but I was always a laboratory guy. I knew enough theory to guide my experimental work, but I always worked experimentally.

Bob Sheldon: Were the labs well equipped there in England?

Mark Lewellyn: They were very well equipped because the whole purpose of setting up this university was to make it another center of science, in addition to Cambridge. So they had very good equipment. Of course, when I went to Berkeley, I saw what big-time science was really like in the United States, with all the Energy Department money that went into Berkeley when I was there. And all the Atomic Energy Commission (AEC) money that had been put in there during and after WWII. I saw what big-time science was like at Berkeley, but compared to my undergraduate laboratories at Hamline, East Anglia was extremely well equipped. They had the latest magnetic resonance equipment that I was working with, so it was quite interesting.

Bob Sheldon: Did you see other interesting parts of England while you were at East Anglia?

Mark Lewellyn: I made several trips to London, which was less than two hours away by train. I also took a vacation to the Lake District in northwest England with one of my colleagues. The Lake District is mountainous with many hiking trails. It is where Wordsworth was inspired to write some of his greatest poems. I spent a week in West Berlin and West Germany, which was sponsored in part by the West German Fulbright Association.

Bob Sheldon: Leaving East Anglia and coming back to the US, was it a given where you were going to go to school?

Mark Lewellyn: Oh yes. I'd been accepted at Berkeley for graduate school and got the deferral for a year, so I could go do my Fulbright in England. So I came back to Berkeley. I got back in the US in August of 1973 and was at Berkeley in September of 1973 to start grad school.

Bob Sheldon: I have a trivia question. Backing up a couple of years, were you subject to the draft lottery?

Mark Lewellyn: Yes. I had the highest number in September of that year. I remember that was the first draft lottery that I was in. I hadn't paid much attention to it. My birthday is September 18th. The lottery had started, and I went to the TV room in my college dorm. The draft lottery was on live, and people were watching it. And I said, "What was number one?" And they said, "I can't remember, Mark. It was something in September in the teens." So my chance of being number one had gone from one in 365 to one in seven. You know: 13, 14, 15, 16, 17, 18, 19. But September 14 was number one, and I was September 18 and that was 246, as I recall. It was the highest number in September. And the interesting thing about that draft lottery was they didn't mix up the capsules with the numbers. They just had them in January through December. They flipped it once and reached down, and when they reached in about a hand's length down, it was September. So the bulk of the initial drawings were all in September and October that year.

Bob Sheldon: My draft lottery number was 23. If it hadn't been so low, I'd probably still be in Minneapolis working at the Pillsbury Company R&D Labs. Let's take you back to Berkeley. How was your transition going to Berkeley?

Mark Lewellyn: My time in England served me well. Berkeley had the top-rated graduate program in chemistry at the time and did the whole time I was there from 1973 to 1977, and I think it still is in the top five.

It was very much what we would call a meat grinder. You spent your first month or so at school trying to line up a thesis advisor. I knew the areas I wanted to work in, so I interviewed with a couple of professors, and the one I wanted was the one that picked me. I remember talking to him. His name was Charles Harris; he died about 10 years ago. He was an ambitious associate professor at the time, and he had a very active group of graduate students. He said, "Now Mark, this is an important decision. Before I accept you officially, I want you to go home and sleep on it overnight. Make sure you want to do it." So I said, "Okay." And I slept on it that night and was at his office the next morning at nine o'clock. And I said, "I thought about it. I still want to do it." He said, "Great." He took me to an office with three other graduate students and said, "There's your desk. I expect you to be here every day of the week, 18 hours a day, until you've finished your research. Thanks for your service. Bye-bye." And that's basically the way I worked. I still remember that first year. On Christmas Eve, I worked till 11:30 at night. And I was not alone. A bunch of postdocs were in working. So that was the environment I was working in. Very much focused on producing research for your professor, and my professor was good. He got a lot of grants, so we always had plenty of money to fund our work. But the best thing that happened to me at Berkeley was one of the postdocs he got the year after I joined was Ahmed Zewail, who later went on to a professorship at Caltech and won the Nobel Prize in chemistry in 1999. So the fact that I worked for two years with a postdoc who later won a Nobel Prize shows the tenor of the level of research that was going on at Berkeley. I got to work with very top-level people. Another one of the guys I worked with became the chairman of the chemistry department at Stanford. So for people that stayed in chemistry, UC Berkeley was a great organization, a great institution to go to.

Bob Sheldon:

Can you describe your research at UC Berkeley?

Mark Lewellyn:

One of the big issues at the time was how energy propagates in solids. The issue was to get to what was called the room temperature superconductor. Something that could conduct electricity at room temperature with minimal resistance. Conventionally at the time, most electricity was sent over copper, because it was moderately affordable. It was certainly cheaper than gold or silver. It was durable. But it did offer power loss because it wasn't a superconductor. So the idea was, can we do research to help us understand how we get it to room temperature superconductivity. A lot of my work was looking at energy conduction in what were called insulators - things that normally

didn't conduct electricity at room temperature, but near absolute zero, they would. So I did a lot of work on superconductivity at low temperatures with solids to understand how the orbital structure of different compounds would facilitate energy conductivity. It was interesting and kept me busy and out of trouble.

Bob Sheldon: Did you write your dissertation on it?

Mark Lewellyn: Yes I did. I worked with two compounds. One was a compound called tetrachlorobenzene. Another one was called pyrimidine. These were relatively flat molecules that when crystallized stacked up parallel to each other, so the orbitals of their atoms overlapped. We wanted to try to understand how that overlap facilitated energy transfer, primarily looking at white light moving through those crystals. We did a lot of experimentation with how pure the crystals needed to be. We did a lot of what was called doping; that is, we would get a crystal that was highly pure, like 99.9% pure, and we would put 1% contamination in it of the same molecule with a deuterium in one site, instead of hydrogen, and we would look at how that affected the energy propagation. A lot of my work was focused on that and was done with optical spectroscopy, which is very sensitive. So you could examine the impact of very small levels of impurities on energy transfer in solids.

Later on, a lot of the work in superconductivity shifted to other types of organic metallic compounds. Today, a lot of the high-level superconductors can conduct electricity up to liquid nitrogen temperature, which is about minus 320 degrees Fahrenheit. That's where the activity is now. So a lot of the Maglev trains use conductors where the metals are cooled to liquid nitrogen temperatures to operate. There is still research in this area, but I played a very tiny role in advancing that research.

Bob Sheldon: Did you use any statistical design of experiments to guide your experimentation at East Anglia and Berkeley, or were your experiments largely directed by your professors?

Mark Lewellyn: I developed my research in cooperation with my thesis advisor, Professor Harris, and his various post-docs, including Ahmed Zewail. My research was a variation of "crawl, walk, run." I developed my early work in consultation with others but was doing most of my work on my own by the time I left.

Bob Sheldon: So you walked out of Berkeley with your PhD in hand.

Mark Lewellyn: Right, I did. My thesis was accepted in the summer of 1977, right after the deadline for spring graduation, so I got pushed to December of that year. By that time I was working in Arlington, Virginia, and didn't have enough money to fly back to participate in my graduation. So I never was at the formal hooding ceremony at Berkeley for my PhD, but I did get my degree. The key date was when the title page of your thesis signed by all members of your committee and that happened in the summer of 1977.

George Akst: So here you are with a degree in a highly specialized field in chemistry, and then you go off and decide "Screw chemistry. Let's do some operations research instead." How did that come about?

Mark Lewellyn: That came about because I looked at some very good associate professors at Berkeley who didn't get tenure, and I watched them beat their heads against the wall for years trying to get tenure. And then after seven years of not getting it, they had to leave and go someplace else. One of my favorite professors was a theoretical chemist named Bill Gelbart, who ended up going down to UCLA where he got tenure after he couldn't get it at Berkeley. And I said, "I don't want to get involved in this academic stuff. It's just too frustrating, and I just don't enjoy it, and I wouldn't enjoy it." Basically, after I'd been in graduate school a couple of years, I looked around and said, "What else can I do with a PhD?" Most of the companies I interviewed with when I was looking for jobs were either industrial or they were organizations like the Institute for Defense Analyses (IDA) and the Center for Naval Analyses (CNA) and RAND, that were recruiting graduate students and the scientists for doing stuff that were scientific in nature, but not formal research.

When I was an undergraduate at Hamline, they had something called the interim, when they went to an interim instead of a strictly semester system. They stuck in a month in between fall and spring semester, where you just did one thing for a month. During one of my one-month sessions, I did a one-month study of Robert Oppenheimer and his role as a scientist working on government projects. He ran the Manhattan Project, the research on it at Los Alamos. I was fascinated by scientists working for the government, so that's when I got an interest in doing scientific work in the government, when I was an undergraduate. When I had the opportunity to look at RAND and IDA and CNA, I thought it would be interesting to interview with them. When I interviewed with the CNA folks who came to Berkeley, I hit it off really well with one of them, a guy named Larry Cohan, who was one of the group directors at CNA at the time. He got me interested and I

applied to CNA and was made an offer at the time. I was also interviewing with General Electric's research facility in Schenectady, New York, which was the other organization that was interested in hiring me. I opted to take the CNA offer, and I started at CNA in the fall of 1977.

George Akst:

So halfway through graduate school and working your tail off in chemistry, you made the decision to get the degree and move on to something else?

Mark Lewellyn:

That's right. I was talking to people at the time. Should I just quit and go to work now and forget about getting a PhD? Get my master's degree, which you could typically get after one year in graduate school. At Berkeley, you took your oral exams at the end of your first year. The philosophy at Berkeley was you did your orals at the end of the first year, when the faculty could still affect the shape of your research. I passed my orals at the end of the first year. One of the side benefits of passing your orals at the end of the first year was that you could get a master's degree at the time. A lot of guys and gals quit at that point because they had the same concerns I did about: would I want to beat my head against the tenure issue at the good schools, or do I want to go off to industry and do something else. At the time, I talked to people I trusted - other professors - and they said, "Oh Mark, stay in school. A degree from Berkeley is going to be worth a lot of money down the road." So that's what I did. But I began looking for other opportunities for work, other than tenure track teaching positions, after my second year in grad school.

George Akst:

Did you have any serious looks or offers from any other operations research kinds of organizations at that time?

Mark Lewellyn:

No. After I was interviewed by IDA, I was just not impressed by the fellow who interviewed me. I can't remember who it was. I asked about research. At the time they were doing work on the classic problem the Marines are always worried about. What caliber should small arms ammunition be? It was the old 7.62 verses 5.56 argument. IDA was doing research on that in Vietnam about which was more lethal: a 7.62mm round from a Kalashnikov or a 5.56mm round from an M16. That research didn't excite me much at all, and the guy from IDA, who was interviewing at Berkeley, clearly didn't have his soul in it. Not only with me, but not with anyone else that year, I think. So I was not interested in pursuing IDA further. But the CNA guy, Larry Cohan, was really interesting as was the stuff he talked about on the opportunities at

CNA. None of which involved the Marine Corps, I will say. They were all Navy stuff.

George Akst:

So you got to CNA and you switched careers, in a sense of going from chemistry to operations research (OR). Talk a little bit about some of your early assignments at CNA - and how did you really learn the field of OR?

Mark Lewellyn:

As I intimated when I was at the MORSS Heritage Session at Quantico a couple months ago, when I got there, I reported and Larry Cohan, who was the group director, was on leave when I came. So I talked to Fred Berghoefer, who was the deputy director. At the time, CNA was working on what was called the CSTAP program - the Chief of Naval Operations (CNO) Studies and Analysis Plan - for all the work for the year was set up at the start of the fiscal year. Every study that CNA did was one year long. It started at the start of the fiscal year and ran the whole fiscal year. The study I was put on was what was called the Future Amphibious Ship Study - AmShips. It was, basically, "This is what we want you to work on." My first study director was Art Maloney. The Navy was facing block obsolescence for a lot of their amphibious ships. LPDs (landing platform, docks) - some of the early LPD class ships were retiring. The LKA (amphibious cargo ship) break bulk ships were retiring. They just bought a new ship, the LHA (landing helicopter assault), which could carry some portion of each of the assets (helicopters, landing craft, vehicles, and cargo) the Marines needed.

The issue was, do we need to buy ships to replace LKAs in kind or LPDs in kind, or do we want to have a balanced ship? When I came in, my project director Art Maloney said, "You know, I think this is someplace we could probably use linear programming. So here's a book on linear programming. Why don't you figure out if this will work for this particular problem." Here I was, trained in chemistry, although, as I've said, "A physical chemist is what I've always called a second rate physicist, a third rate mathematician, and a fourth rate computer programmer." So I sat down with a book on linear programming to figure out if it could be used for the problem, and I decided it could. At the time, CNA did not have an integer linear programming application that could run on their Burroughs computer, which was down in the basement of the building we were in. But they did have a non-integer linear programming capability that I started to work with on the problem. So that's how I got to do it.

Bob Sheldon:

Could you talk a little more about how you tackled your first linear programming problem? What went into your objective function? What kinds of constraints did you formulate? Was it easy to put that into an ancient Burroughs computer?

Mark Lewellyn:

The objective was to determine which mix of amphibious ships could carry all the Marines, vehicles, cargo, helicopters, and landing craft needed for the assault echelon of a Marine Amphibious Force at the lowest cost (both acquisition and life cycle). When I started, we had no integer linear programming application in Fortran that could run on the Burroughs. However, by the end of the project we purchased an integer linear programming program, which took a long time to converge toward a solution on the Burroughs.

My first project director also said, “We want you to learn general background in OR, so read these books.” And he gave me the ones I mentioned at Quantico: *Methods of Operations Research* by Morse and Kimball, *Search and Screening* by Koopman, and *The Economics of Defense in the Nuclear Age* by Hitch and McKean. These books, published in the 1940s and 1950s, are among the “bibles” of operations research and systems analyses (at least they were when I was there, and I still think they’re invaluable). The tools and techniques I used during my first ten years in “the business” are but a small subset of those covered in these books. I kept copies of these texts on my bookshelf during my 40-year career and often consulted them. They represented the true “giants” on whose shoulders I stood. I used to study those books every day on my lunch break. I remember reading through *Search and Screening*, which was driving me nuts, because I couldn’t really understand some of the principles in it. One day, when I was at lunch, I was reading *Search and Screening* and Art Maloney, who was at CNA for most of his career, came by and said, “Oh, I see you’re reading *Search and Screening*. Are you getting all of it?” And not wanting to appear a fool I said, “Yes. It’s quite interesting.” He said, “Oh, really. You understand it, Mark? Maybe you can explain it to me someday.” [Laughing] So I always thought that was a good comeuppance for me.

When I first came to CNA in 1977, there was no PowerPoint then, the rule was, “If you’re going to brief a general officer, you needed to have a text.” I remember the first time I briefed a three-star, George Crist, who was the head of Installations and Logistics in those days (later a four-star). He said, “Oh, CNA. Great! You’re the guys with the scripts. Give me the script you’re briefing.” He

flipped through it in about three minutes and said, "Great briefing."
And handed it back. [*Laughing*]

George Akst:

So, you go through your early days, and you start getting somewhat acquainted with ops research. And not too long after that, you decided to take off, uproot your family, and go down to a field assignment. How did all that come about?

Mark Lewellyn:

That all came about because was when I was recruited into the Systems Evaluation Group (SEG). I was recruited on the understanding that after two years at CNA I would do a field assignment. No question. If I didn't want to, I should quit right now. So that was always the understanding I had. At the time, my wife was studying nursing at Catholic University in Washington, DC. And part of the problem of going to the field at the time was we needed to find an assignment where she could get into nursing school, because she was going to have two years to go after her two years at Catholic University. So that sort of limited where I could look at. There were three available field billets opening up that I could go to. One at Brunswick, Maine, which was the P-3 command. The other two openings were down in Norfolk, Virginia. There was the Surface Warfare Development Group (SWDG), which was a Navy billet, and there was the Fleet Marine Force Atlantic (FMFLANT) billet that was open. Those were the two choices for locations that I had.

For the Norfolk billets, there was a great nursing program at Old Dominion University that my wife could get into. We were Virginians, of course, and it was a state school, so there was no problem getting in. She had good grades at Catholic University. The issue at Brunswick, Maine was there was the University of Maine campus, but it would be more dicey for her to get in at the University of Maine because she would be out of state. So one of the things that drove me to choosing between the SWDG and FMFLANT was the fact that she could get into Old Dominion University quite easily. I went on a trip down with two folks. I went with Jerry West to visit the SWDG, and I went with Dean Simmons, who was in the Marine Corps Operations Analysis Group (MCOAG), to visit FMFLANT. They were sort of my hand holders when I went down to interview for those. SWDG was an O-6-level tactics development command, whereas FMFLANT was a three-star-level type command. The people I talked to that day at FMFLANT were interesting, and I had a background in amphibious warfare from the projects I had worked at CNA - the Future Amphibious Ship Study I mentioned lasted longer than a year. It was extended for a second year, so I had worked on that

for two years when I was at CNA. I had done amphibious warfare analysis and knew something about the Marine Corps when I went down to FMFLANT. So that was the billet I opted for.

George Akst:

So you did some Washington-based ship type analysis in your Washington assignment. Talk a little bit about how the work at the field assignment differed from the work back in DC.

Mark Lewellyn:

Quite a bit. There was very little computer support at FMFLANT. Basically, my HP-35 pocket calculator was pretty much my computing support at FMFLANT. At the time, you basically inherited the research projects that your predecessor was working on. The main issue that my predecessor was working on was the problem of disciplinary rates in the Marine Corps at the time, because of the problem with the Armed Services Vocational Aptitude Battery (ASVAB) mis-norming that I talked about at the MORSS Heritage Session. The Marines were getting many more lower-mental-category Marines enlisting than they thought they were because of the mis-norming. They were having a real disciplinary problem in the Corps. One of the problems the field rep was working on was how those disciplinary rates were changing over time. By the time I got there, I did two disciplinary rate reports, which were done quarterly, before they saw things tipping back up and the disciplinary rates were going down because the quality of recruits was going up in the Marine Corps. After that work finished, I started looking around for something else to work on.

At the time, we were assigned to what was called the Force Readiness Section of the Headquarters. That's where the analysts were. I was there with two Marine Corps majors who were on Special Education Program (SEP) payback tours from the Naval Postgraduate School (NPS) in Monterey, California. They were both A-6 affiliated - one was a pilot and the other was a radar intercept officer. And they were looking for something to do too. From looking around, I found out everyone was complaining - in the supporting commands, the division, the wing, and the Force Service Support Group (FSSG) - that they were spending too much time on "non-mission-related activities." They were doing things other than their MOS-affiliated work. So I proposed a project to the head of the Force Readiness Section - a Marine O-6 -- that I go down and try to determine the amount of time Marines were spending on non-mission-related activities.

It was a great introduction to the Marine Corps. I went to almost every unit in FMFLANT at the company and squadron level to

determine how much time each Marine was spending on MOS-related activities. For Infantry units, it was pretty cut and dried. Most of the time, they were working on Infantry MOS-related activities. But occasionally they'd have to do things that weren't affiliated with it. A big bugbear at the time was what was called the Fleet Assistance Program (FAP). The FAP was basically a program by which Marines would be temporarily assigned to the base to do things like mowing grass and things of that sort, so the base commander wouldn't have to pay for it separately out of his limited budget. I went through unit diaries in FMFLANT looking at the amount of time people spent on non-mission-related activity. For the Infantry units, it was on the order of maybe 20% of their time. But as it turned out for units in the FSSG, it was on the order of 30% to as much as 60% of their time they were on activities other than related to their mission as maintenance people or whatever. I took that report back to the Commanding General. I remember briefing the leadership team at FMFLANT, basically all the section heads, on the results. I remember them all swallowing, gulping, and saying, "Oh! What do we want to do? Do we want to tell these units to focus more on mission-related training? What does that mean?" They decided at the time to kick the ball down the road. Say, "Our OR guys found this result, and we think it's troubling. If you want to do something about it, go right ahead." But there was no decision taken at the upper level, so I think that had limited impact.

But it was good for me, and it got me exposed to everything that was going on in the FMF. As a consequence of that, I got called for other work. One of the things I worked on was the effect of the Target Acquisition Battery (TAB) in the artillery regiment. They acquired a target acquisition capability, and they wanted to understand how well the TAB was working in the artillery structure. At the time, the Army was buying fire direction radars. They had phased-array radar to track artillery shells and mortar shells, and they were using that for counter-battery fire. Those pieces of equipment were too expensive for the Marine Corps, but the Marines did have flash and sound ranging capability, which basically dated from WWI. It was one of the things that Thomas Edison worked on for the Army – flash and sound ranging - when he was in charge of operations research in WWI. So I went down to Fort Bragg to fire exercises and looked at how well that capability worked for the Target Acquisition Battery.

Later on, I got involved in the Marine Corps Combat Readiness Evaluation System and went on a lot of combat readiness evaluations for Battalion Landing Teams (BLTs) that were getting

ready to deploy. One of the things I was assigned to look at was how well the Chemical, Biological, Radiological (CBR) training was working, worrying about poison gas and how quickly Marines could put on their poison gas equipment and things of that sort. I did a couple of the landings in LVTPs and got to know fairly well how the Marines operated at the battalion BLT level. It was interesting work. Most of what I was involved in related to logistics and things like Combat Readiness Evaluations (CRE) and very little to do with actual tactics development when I was in the Marine Corps as a field representative. But I had a good time. I learned a lot. I wrote a bunch of interesting field letters. I remember the President of CNA, Dave Kassing, always said he looked forward to reading my field letters, because for the first time, the ones written for the Marine Corps were interesting. I'm not saying they were all substantive, but at least they were interesting to the President of CNA.

George Akst:

So you put in your two years' time. You checked the box. You're back at CNA and I believe you continued to do a bunch of Marine Corps work and ultimately lots of Navy work as well. Can you talk about your transition back to CNA and your early work when you got back?

Mark Lewellyn:

When I got back, we were in a new office building at the corner of Seminary and Beauregard in Alexandria. It's since been torn down. I was assigned to lead a project for the first time for the Marine Corps. It was called the truck study; the formal name was the Marine Corps Tactical Wheeled Vehicle Study. The issue at the time, as I said at the MORSS Session, was what sort of trucks did the Marine Corps need? The jeeps were going away. The Army was buying a new five-ton truck. The Army was also buying a new Humvee, as it was later called. What should the Marine Corps do? Should they buy Army trucks or develop their own? So we led a truck study for a year that basically looked at everything the Marines needed trucks for.

At the time, the Marine Corps was in the process of going on a big containerization spree. The commercial world was going that way, and the Marines had decided to go to a family of containerized capability called Palcons, Quadcons, and commercial 20-foot containers. A Palcon was a pallet sized container. A Quadcon held four Palcons, and a regular container held four Quadcons, I think. The idea was, we buy these containerized supplies, containerized capability, and all the Marine Corps supplies would fit in those. The only thing that truck force would need to do would be to carry those various sizes of containers. So I took that

and figured out what sort of trucks we would need to carry all those containers. Basically, the answer was it would need to be about six times as many trucks as a Marine Corps currently had. So that led the Marine Corps to look hard at their logistics concepts for moving the Marines around. The main impact we had from that study was the purchase of what was called at the time the "Dragon Wagon," which was a heavy hauler for the heaviest loads the Marine Corps had, which could be separated into two components, and each component was liftable by a CH-53E helicopter. It also had all-terrain capability, because of the way it was structured. That was an influential project at the time. I briefed it all the way up to the Assistant Commandant of the Marine Corps (ACMC) level. The first four-star I briefed was a General Kelly, who was the ACMC at the time. I briefed him and others on the truck study.

This was at the time before PowerPoint, so I had to guess at what sorts of questions they would ask me. I had on the order of 50 or 60 backup charts. Every time I briefed them, and they asked a question I didn't have an answer to, I would build another backup chart. Chris Jehn, who was the head of the Marine Corps group at the time, said he was always impressed that every time I would brief flag officers and they would ask a question, I'd say, "Can I have backup number xx please." And I always had a backup chart for the question. That was influential, in terms of I could see the impact that analysis had on shaping the way the Marine Corps spent money on things like trucks. After that, I got into more Marine Corps work.

At the time, CNA was going through a reorganization. The Hudson Institute won the contract to run CNA, which had been managed by the University of Rochester. They brought in what was called a matrix organization. All of a sudden, there were two sorts of managers at CNA. There were program managers who actually interacted with sponsors and ran projects. And there were department heads, who had what I called the Title X responsibilities to recruit, train, and equip. I went from being a project director to running a program for the Marine Corps where I was in charge of overseeing work on a bunch of different studies. I think at the time, George, you were involved in a project, looking at the Advanced Amphibious Assault Vehicle (AAAV), the replacement for the LVTP-7. You were doing the Cost and Operational Effectiveness Analysis (COEA) on that. That was a project in one of my programs. I think that was one of the first times I got to work closely with you. I remember you briefing the Marine Corps Acquisition Committee that the ACMC had on the

AAAV program. You did a great job as I recall. At the time, that was my first experience of managing others and working with the Marine Corps two and three-star leadership on shaping the study program for the Marine Corps in the area of acquisition for new systems. I worked on that for a number of years and then got into Navy work, because, rightly or wrongly, my superiors thought I was doing a great job working for the Marine Corps. And, why didn't I do some work for the Navy? So I got into working on Navy systems issues - not just Marine Corps systems issues. That happened around the late 1980s.

George Akst:

Let's move on into your management career at CNA. But before we do that, let's talk about the studies that you did that you felt had a big impact on the Marine Corps or the Navy – that actually impacted decisions. Can you think about any of the efforts that you did over that first ten or so years that you think were highlights of your studies, that you think made a difference in the way the Marine Corps or the Navy did things in the future?

Mark Lewellyn:

I think the truck study was impactful because a lot of the reactions I got from folks were, “I'd never thought of the problem that way.” I always thought that one of the best things an analyst can do is to get a decision maker to think about the problem that he's got in the right way, at least in an analytical way. I think that was impactful for me in terms of at least the Marine Corps is that I took the things they were saying they wanted to do and looked at the impact on wheeled vehicles. I then came up with an answer that let them realize what the consequences of some of their ideas were going to be, so they had to change what they wanted to do to be in line with what they could afford to have in terms of wheeled vehicles.

I remember doing a study on landing craft – people did a number of studies on landing craft. What was involved at the time was a lot of the analytical shorthand. People would use what I called fudge factors. They were things like break bulk loading of things like Landing Craft Utilities (LCUs). How much break bulk cargo could LCUs handle? It was basically a factor. You'd say that 67% of the content of an LCU could be used for break bulk. For vehicles, it was somewhat less – 54%. They were just sort of average factors. What I actually did, because the numbers of the landing craft the Marines were talking about were smaller in number than they used to be, was to cut out little shapes representing the vehicles and cargo that would be loaded on the landing craft and looked at ways of loading them in and found out that the break bulk and square factors were different. You could get by with different mixes of landing craft. I did that and I

thought that had some impact on the way people thought about sizing the number of landing craft you needed to support Marine operations. It was a small thing, but I thought it had some significant impact.

Later on with the Navy, one of the big studies I led after I had been a manager for a while was the SC21 (Surface Combatant for the 21st Century) COEA. We looked at what the Navy should do for their next surface combatant. That was a big effort that involved about 100 analysts from three or four different organizations, and a large budget over a couple of years, to determine what sort of surface combatant the Navy needed to buy. I always like to say that that had an effect because we looked at three final options for the Navy. There was one that looked marginally the best, but the other ones looked okay too. The Navy over time pursued all three of those options before it finally settled on the one they're pursuing now, or were pursuing at least, which is basically continuing to build the DDG-51 type ships for their surface force. That was a large study and got me in with the Navy, as some of the amphibious ship studies have, and realizing the tension between analysts and engineers.

Most of the stuff that we did that affected Navy shipbuilding – the analytical work, which was primarily for OPNAV, would focus on performance of planes, of ships, and shipboard weapon systems. But when you worked with NAVSEA, that had the responsibility of building those ships or systems, they would always approach the issue from an engineering perspective rather an analytical perspective of effectiveness. How do you accommodate the stuff on the hull of a ship? How do you make it reliable? How do you make it affordable? And there was always that tension. Most of the work we did at CNA was for OPNAV or for Headquarters Marine Corps. But when it got turned into actual equipment, you'd be working for Systems Commands and understanding the needs of the engineering community. With things like SC21, I would have one set of issues working with the OPNAV folks and with the acquisition community and the Pentagon. And another set of issues working with the Systems Command folks. What I started doing on SC21 and other big studies I did over the years was to always send out weekly newsletters on the project – unclassified mostly – about what the issues were. I'd send them to all the leadership, not only in OPNAV, but also in the System Commands. So you would get all the arguments surfaced upfront between the shipbuilding side and the requirements side. I thought that was effective and I used that in a number of big studies I was involved in, right up to the last one I was involved in, which was

the Next Generation Enterprise Network (NGEN), the replacement for the Navy-Marine Corps Intranet (NMCI). Most of the input we received on NGEN issues were, "Don't make it like NMCI." It was interesting to get involved in that. The Marines and the Navy had very different concepts for running an Enterprise Network. The Navy wanted to contract everything out to civilian technicians, and the Marine Corps wanted to do it all in-house, because it was a combat system. That was their view for both NMCI and NGEN, and they wanted to be responsible for every aspect of it. That was interesting work as well, in terms of network.

Most of what I was able to do in my latter years at CNA was to be both a manager and a project lead. One of the other big projects I led was for the 2005 Quadrennial Defense Review (QDR), starting with President George W. Bush's second term. Gordon England was the Deputy Secretary of Defense at the time. He had the view that, rather than turning it over to the Services to do their QDRs, he was going to set up four separate big studies that would each last a month. CNA was chosen to lead the maritime QDR tradeoff studies, and I was asked by the head of CNA at the time, Christine Fox, to lead that effort. So for a month, I and about 20 other senior analysts at CNA did the maritime component of the QDR for 2005. That was interesting because we got into a battle rhythm that pretty much every day, we'd do work, we'd brief three and four-star level people in the Navy and across the OSD and get their reactions. Then we'd come back and crank the analytic handle again, and then come back in a day or two with new results.

We did that for a month. That was doing nothing but analytical work for a month. The culmination of that, I can still remember, was a Saturday session with Gordon England and Admiral Giambastiani, who was the Deputy Chairman of the Joint Chiefs of Staff at the time. We briefed them on a Saturday morning about the findings of the Joint Maritime Integration Study (JMIS). We had about 12 or 13 issues, and we did studies on each of those issues by basically pulling together work that CNA or others were already doing on it. I spent from like eight in the morning till two in the afternoon briefing those guys. I still remember: to my right was Admiral Willard, who was the Vice CNO at the time; and to my left was Christine Fox, who was the President of CNA. I briefed Gordon England and Admiral Giambastiani for six straight hours on these studies. The briefing went quite well; it couldn't have gone better. It was extremely rewarding for me because here I was, briefing at the highest levels of decision making in the Department of Defense (DoD) - not just the Navy - and drawing on the best analytical work that CNA had to offer at the time, and

having an influence at a high level. I eventually got to brief all the senior leadership interested at the time. By then, Pete Pace had become the Vice Chairman, and I remember General Pace chaired the group I briefed. It was an interesting time, and having impact at the high level, although George will probably say, “Well, the QDR sort of had some impact.” And they did at the time too. But I thought that was sort of nirvana for me, of taking everything I learned over the years and briefing at very high levels of decision making for the DoD.

I enjoyed that, as well as taking my week off after that month of doing work. [*Laughing*] I remember at the time, I had to take my oldest son back to school in New York City. I argued with the sponsors of the study in the Navy, which was in N81, “Could I please go away for 12 hours to drive my son up to New York and drop him off at school and stay overnight in the hotel and come back first thing the next day?” I remember unloading all my son's stuff in his dorm room in New York City and heading back home and talking to people on my cell phone on the drive back about JMIS. I'll always remember that. It was when the hurricane hit New Orleans. Katrina had just moved through. All the news at the time was about how bad things were in New Orleans. So it melts together in my mind – Katrina, JMIS, and all this work we were doing.

George Akst:

That was certainly an in-depth answer to the analysis question, which is great. Let's move away from the analysis and talk about the various management positions you had at CNA.

Mark Lewellyn:

Everyone started out as a project director, so my first project I talked about was the truck study. I had about four or five people working for me on that for a year. It was interesting figuring out how to delegate work and how often you have meetings. This was still in the days before email and a lot of capability to do collaborative work online. I was fortunate to have a good group of people to work with.

My next management challenge there was becoming a program manager, overseeing five to ten studies at any given time, initially for the Marine Corps and later on for the Navy. Working primarily in the Marine Corps for Research, Development and Studies (RDS) at Headquarters Marine Corps, which ran the studies program at the time, and later on with Quantico when most of the studies responsibility moved down to Marine Corps Combat Development Command (MCCDC). So I interacted with a lot of the leadership at Quantico. With the Navy, it was primarily always with N81, the

analytical arm of OPNAV that set up the analysis program for the Navy at the time. Basically, as program manager you would review and approve study plans and rehearse sponsor briefings. The project directors would give the briefings and the program manager would be in the room to listen to any issues and consequences. It was sort of a lesson on how you delegate responsibility, and also you let people that knew the work take the benefit of the praise the work gets, and any condemnation of the work. The manager works with the analysts to try to do better next time.

It was when my training with the Marines came to light. I remember the old line about “troops always eat first,” and I saw that myself when I was working with the 10th Marines when we were doing the Target Acquisition Battery work. I would always eat with the colonel of the Regiment, and he never ate until all of his Marines were fed. I took that on board in terms of leadership vision for myself going forward. I always thought the Marines were much more fun to do analysis for, and they treated you more as a member of the team. Whereas in the Navy, you were an analyst and you were with CNA. You sort of represented that organization, but you were never really treated as fully as a shipmate as I thought we were when I was with the Marine Corps. But I developed some very good relationships with admirals I supported in the Navy. I never did a field assignment aboard ship, which was something a lot of people at CNA did. So I never got the feeling of actually being in a shipboard environment with the Navy at the time to understand that, because I’d done my field work with the Marine Corps.

Later on in 1997, I was asked by Bob Murray, the President of CNA, to take leadership for developing CNA’s work outside of DoD. So for a couple of years, I ran what was called our Institute for Public Research, where we did all of our non-DoD work. I organized quite a bit of work for the Coast Guard. I thought the Coast Guard was very interesting, because compared to the Marines, they were even poorer in terms of the amount of acquisition money they had to spend. Doing work for the Coast Guard was always a challenge in that it was complicated work, just like the Navy, with ships and other equipment, but they had much less money to spend on it. So it gave me an appreciation for the different decision environments people in the government operated in. I also did work at the time for the Border Patrol. I remember working on the southern border issues concerning the amount of illegal immigration that happens across the southern border of the US. So I got involved in that at the time, and I actually drew on a

technique from search and screening. You're basically setting up a barrier screen along the border. It was just like setting up a barrier screen against submarines. It was interesting how things came back to be useful that I learned early in my career.

George Akst:

So you finally figured out what that old study really said?

Mark Lewellyn:

That's right. So it's "all problems are the same." I think it was Goethe who said, "There are only 40 possible plots that a fiction story can ever have." Or some limited number of plots. And I think there are only some limited number of physics problems governments can get involved in that you can turn back to look at. After that, in 2000 I was asked to become Vice President of a big research division at CNA - Advanced Technology and Systems Analysis, where we did pretty much all of the Analysis of Alternatives (AoA) and systems-related work for the Navy. I had about 80 to 100 folks in that division, supporting a broad spectrum of work on technologies, primarily for the Navy, although some amphibious warfare work related to what the Marines were interested in. So there I was dealing with everyone in the N9 organization - what we now call it now. At the time it was the N8 or the N7 organization of the Navy where they looked at all of their acquisition to support warfighting issues. I got to work a lot in that area, going to morning meetings with the senior leadership of the Navy and seeing what problems were like at that level and how they were handled and how different CNOs handled those issues. The other interesting story I'll tell from the time was sitting in on meetings with a couple of CNOs - I won't give names - and ASN (RDA) [Assistant Secretary of the Navy (Research, Development and Acquisition)], who basically used the technique of when they didn't like the way a meeting was going, they would stand up and walk out and leave the briefers to figure out what they were going to do about it. One of them - I won't say who - called me afterwards and said, "Mark, I hope you weren't bothered by that." Because I was one of the people briefing at the time. "But it was just the technique I wanted to use to let those guys know I wasn't satisfied with the way they were approaching the problem." So I said, "Well, thank you for letting me know." [*Laughing*] I got to see different leadership techniques. I don't know how common they are. I don't know if I'd say that they were good techniques or not, but I saw them exercise that at both the four-star and the senior civilian level. I tried to use that myself at CNA.

George Akst:

Before we move on to your next career, throughout much of the history that we've been talking about so far, CNA was fairly heavily involved in fairly large-scale models and simulations.

Somewhere around the 1990s, I don't remember exactly when, CNA definitely begin to sour on some of the larger scale models such as campaign models, like STORM. There was a large contingent of people who were very anti-large campaign models. There was another set of people at CNA who felt that was a mistake, and that the Services were going to continue to use these large-scale models, whether CNA supported them or not. What's your position on that?

Mark Lewellyn:

Well, as I said early on when you asked me what sort of work I did in graduate school, I've always been an experimentalist. I've always believed in primary data sources and data you can collect yourself. My main issue with models is that, just like theoretical work in chemistry or the sciences, the real power of models or theories is not whether they can explain the past, but if they can predict things that haven't happened yet. My sense of a lot of models is that they were structured at the time to be able to explain what happened in the past. Whether they could predict what would go on in the future was an issue.

I had a lot of discussions with Trip Barber, who was Deputy Director of the Assessment Division in the Office of the CNO, about well, if you're using it for acquisition, you're doing relevant comparisons of different systems' performances with these models. So that's a different issue than actually predicting how these things will work in the real world. I think there was a view at CNA because it was so strongly shaped by OEG, and the fact that OEG was focused on collecting real-world fleet data. The issue in OEG was that you needed data to be able to explain what was going on today and use that to predict what we needed to change for future systems. The concern about large models was – could they predict the future?

Things have changed quite a bit since those days. My one experience with a big model was when I was doing the SC21 COEA. There was a proviso in the guidance for that study that you had to use campaign modeling that the Office of the Secretary of Defense (OSD) Program Analysis and Evaluation (PA&E), which later became CAPE (Cost Assessment and Program Evaluation), had written in. More specifically PA&E wanted us to adapt the Tactical Warfare (TACWAR) model for use because they were most familiar with that campaign model compared to others that were available. Ted Smyth, who was working at APL at the time (APL was one of the supporting organizations for the SC21 COEA), was in charge of the campaign analysis for the SC21 COEA. Ted and his team spent multiple weeks over several

months at Fort Leavenworth being schooled by Mike Bauman's TACWAR experts to adapt TACWAR for use in the COEA. What we learned from the application of TACWAR to the COEA was that there were occasionally problems where the results that came out of the model didn't make sense. Ted and his team would backtrack to find out what was going on. There were cases in the code for that model where certain things were hard-wired not to be able to work, that were physically possible. So the team would go back and figure out why the code was hard-wired against systems working a certain way. "Oh, it's because in the past, they had a problem with an Army system that wasn't behaving like they wanted it to. So they just hardwired it into the model - its ability to do what it was doing." I never knew how much of that was in a big model like TACWAR. Hopefully, today those large models, because they're built more on Unix-based systems and object-oriented programming and coding, are more transparent in terms of what sort of decision making goes on inside.

But that was my one exposure to campaign modeling, and part of my view about the value of models and the scientific method in general, was that the scientific method is only valuable if it can predict things that aren't known yet. A good example of this is the classic story that while Dirac's quantum mechanics predicted the existence of anti-matter, it wasn't until the positron (the anti-matter associated with the electron) was discovered that scientists thought that Dirac's quantum mechanics was valid. Dirac's version of quantum mechanics was great, because it not only explained existing phenomena, but it also predicted phenomena we didn't know existed. I always thought that was a classic example of how the scientific method should work.

George Akst:

At some point in time, you decided to leave CNA and move to a next career, going to APL. How did that come about?

Mark Lewellyn:

That came about because when Christine Fox left as the President of the CNA to go into government, that position opened up. I was one of the many people that interviewed for it. I'd been a vice president for ten years, so I looked at the chance to become President of CNA as an opportunity. So I interviewed for that. I was one of several internal candidates, as well as external ones. I made the final group but didn't make the final choice. Paul Speer got chosen as the President of CNA. It was a fair process; I have no complaints about it. I sort of said, "Do I want to be a vice president of CNA for ten more years until I retire? Or do I want to do something else?" Just at the time, fortuitously, I got called by a headhunter who was looking for someone to head the analysis

department at APL. So I said, “Sure, I’ll interview for that.” I’d worked with APL over the years. They were part of my team on the SC21 COEA and I’d worked with them on a few other things as well. So I went up to interview for that. CNA, even counting part-timers, was only about 500 analysts. APL had close to 6,000. It was a much larger organization. It was an engineering organization. It was a University Affiliated Research Center (UARC), as opposed to a Federally Funded Research and Development Center (FFRDC).

Because of my interest in the Systems Command perspective on issues that I talked about earlier, I thought it would be a great place to work, to go up and head the analytical group at APL. That was a group of around 200 folks who supported all the engineering work with analytical help. So I went up and interviewed for that. And, as I said, the people I interviewed with were heading big departments at APL that were 1,000 people strong – all engineers. I was going to have one of the smaller departments of the laboratory. It was interesting to be interviewed by those folks, including the director of the lab, Dr. Ralph Semmel, who I thought was just an incredibly interesting and talented guy. It was a real opportunity. The more I interviewed, I thought, “Gee, I hope I get this job.” So when it was offered to me, I said, “Sure!” That happened in the spring of 2011 – April 11, 2011 was my first day at APL.

George Akst:

You talked about working for an FFRDC and then a UARC. How did you find the differences between a UARC and an FFRDC?

Mark Lewellyn:

APL is the largest UARC in the United States. It currently has 8,000 people. Basically, what I found is they ran a much tighter ship than CNA did. I can't speak for the other FFRDCs, but as a department head at CNA, I was given an overhead budget, and I was told, “Here’s your overhead budget. Try to live within it. If not, we’ll understand if it's a good reason.” But at APL, it was “Here’s your overhead budget. That’s it. If you can’t live within that budget, you’ve got to start firing people.” It was a much tighter run ship in terms of the way it was run – very engineering oriented. Much more of the work was done in engineering teams. Most of the offices at APL were shared offices, whereas almost all the analysts’ offices at CNA were private. It was much more team-focused work at APL.

The projects were exceptionally big by comparison. We had a big contract at APL to support the Aegis Program at NAVSEA, and there were literally tens of millions of dollars supporting that work,

so literally hundreds of people working on support for the Aegis Program. It was a different environment. Most of the studies I coordinated in my group were smaller efforts, as most analytical efforts go. APL was a “.edu” - which made a lot of difference. We were a part of The Johns Hopkins University, so we were involved in all of the politics of the university. We met with the President of Johns Hopkins on many occasions. He had the view of the whole spectrum of work at Johns Hopkins. The big moneymakers for the University were APL and the medical system, the hospital at Johns Hopkins. Those were the ones where most of the fee generated by the government came in to the benefit of the university. The university leadership was very interested in the work at APL as well as that of the Johns Hopkins medical system. It was interesting exposure to academic work, the first I'd really had since I'd been at Berkeley.

George Akst:

Talk a little bit about some of the analyses that you did at APL and some of the ones that you think were significant and had an impact.

Mark Lewellyn:

I can't really talk much about some of the interesting stuff that we worked on because most of the engineering work was highly classified. We did a lot of work on what sort of systems made the most sense for anti-access area-denial work. A lot of that work was highly technical, highly classified, and let's just say it had an impact at the highest levels of OSD, and that's about all I can say about it. Much of that work is still very highly classified. I've given up all my clearances now, but I still want to be very careful about what I talk about. But basically, anti-access area-denial work. Dean Simmons, who worked in my department before he retired from APL, who had worked at CNA and then IDA for a number of years, was involved in that work. And a lot of the higher-level civilians at the Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L) were involved in that work, as well as parts of the Air Force and the Navy research and development community. It was very interesting work and very exciting.

We did a lot of work in support of Navy medicine. How can you make Navy medicine more efficient? It was a lot of work involved with how patients were treated in hospitals and how you could re-engineer hospitals through organizational engineering to be more efficient. We spent a lot of time at Walter Reed and at Bethesda looking at how Navy medicine treated patients. That work eventually led to the foundation of a separate department at APL, a research area that focused strictly on health and health engineering.

A lot of that work was done in very close cooperation with the Johns Hopkins Medicine. It was a smaller area of work that we worked on. Basically, how can all the machines that a sick patient is hooked up to in a hospital share their data? The way things in hospitals work today is that each sensor that goes on a patient goes to a separate data sink where the data is collected. And it's not shared. And the links across systems have to be physically connected, so information from one machine had to be copied down by hand and taken over to another machine and fat-fingered in, as opposed to linking machines over networks like they do on combat systems on ships. Developing the analogues to integrated combat systems in hospitals was a project we started to work on, and it's now being led by other folks. There's a legal element in patient information and data. There's an element of what the doctors are responsible for, and what machines are responsible for at hospitals, and what nurses are responsible for. But basically, it was applying technology, and it's still work applying technology more smartly to healthcare, both to lower costs and raise the efficacy for patient treatment.

We did a lot of work that's important now on managing tactical nuclear weapons. All I can say about that is, "What are the responses if someone else decides to employ battlefield tactical nuclear weapons?" APL has published a number of publicly available reports on that. Most of the people doing that work on nuclear non-proliferation and deterrence were in my department. That was a whole area of work that was separate and interesting that we worked on, as well as work about how does that fit in with cyber deterrence. We did work looking at the Sony Pictures hack that the North Koreans were supposedly involved in, how that worked, and how that could be used to affect the US, and how you would deter against attacks like that with the capabilities you have. Again, a lot of that work was highly classified so I can't talk much about it. But it got into sort of the nexus between policy and technology. That was a fascinating interest for me towards the end of my career, about what can analysis do to help build that link between policy and technology?

George Akst:

Did you do any work outside of the Navy, or even outside of DoD when you were at APL?

Mark Lewellyn:

Most of our work was for DoD in my department. Again, more Service work. We did work that the Air Force was very interested in. We did some work for the Army. I found out the Army, in my view, wasn't nearly as good a consumer of analysis as the Navy was. I didn't have that much direct experience with the Air Force,

but the Army, at least on the projects I worked on, was much more: “We know we want this answer. Can you help us get it?” Actually, on one project, we had to say, “Well, that's a very interesting problem, but if you know what answer you want, you really don't want to pay for a UARC or an FFRDC to do it. There are plenty of good private sector companies out there that can help you get to your solution.” “But we want the imprimatur of a UARC to say that we're doing the right thing.” “Sorry. We can't do it.” “Well, you're walking away from a couple million dollars.” “Well, we'll have to walk away from a couple of million dollars.” I had a lot of tension from people on my staff that said, “We shouldn't walk away from that much money!” But we did. The leadership of APL was all for me on that one. Generally, they wanted to make sure that UARCs worked on stuff that UARCs should work on, and not stuff that private companies can do just as well, probably for less money.

George Akst:

I seem to recall that APL had sort of a retirement policy that when you reach a certain age, they kick you out. Were you ready to leave APL when they told you that you should be leaving?

Mark Lewellyn:

One of the things at APL was that you could not serve in an executive position, I think it was a Johns Hopkins' position, too, past age 67, whatever the Social Security full retirement age was. When I started, it was 65 or 66, and then they raised social security levels, I think to 67 or 68, whatever it is now. Those were the levels, and you could serve past that with the approval of the head of the laboratory. When I was hired, I was 60 years old, and they asked me about my feelings about that. I said, “I'll work as long as I can, and basically serve at the pleasure of the lab director.” I must say, I thought when I was 65, I'd probably work till I dropped dead. But by the time I was 67 or 68, it got a little tiresome, at least being at the executive level. At the executive level, you work with the politics of the university, the politics of a large research organization, the hiring and personnel management issues, and things of that sort were no longer giving me “joy” – to use the word that's common now with people that tell you to clean out your closets and stuff. When my retirement age came up, I was extended. The head of the lab asked me to stay for six months past my mandatory retirement level at the time, which was 67. So I said I'd be happy to do that. And he said, “Just take me through the next board meeting that you're responsible for.” Each department had to take turns being responsible for a quarterly meeting of the APL board, and my board meeting was in February of 2018. So I served through February of 2018 and retired on the first of March of 2018.

I went part-time on-call after that. The idea was, if anyone was interested in having me work past then, I'd be able to. I took a reduction in salary down from the executive level, which was fine. I was not pursuing doing any work myself. I was traveling a lot and having a good time, and no one ever called me for work. So after six months I said, "I guess that's it." The hardest thing for me to do was give up my clearance. I realized once I gave my clearance up, that was sort of it. I remember signing the papers to give up my clearance in early October of 2018. That's when I signed the papers and left APL, and that's when I fully retired. I miss the people - not the work in particular.

George Akst:

Looking back over your roughly 40-year career in ops research, who were your role models or mentors during that period?

Mark Lewellyn:

I think my first real analytical mentor was Art Maloney, who was my first project director at CNA. He had three types of graph paper on his desk. He had regular graph paper, semi-log, and log-log. He said, "I can't understand a problem until I can get a straight line on one of these papers." And that was sort of what really drove me early in my career. Later on, I met a guy named Rich Bronowitz, who was a Vice President and head of OEG, who had exactly the opposite view. His view was, "If I can understand a problem with graph paper like that, I'm not really understanding it, because no problem worth understanding is that simple." So those two views sort of bracketed my two analytical leaders.

On the military side, I was influenced on the Marine Corps side by General Barrow, who I worked with when he was Commandant of the Marine Corps. But also, he was on the CNA Board of Trustees, and I worked with him then. He had a real good what I call "senior leader sense" of how analysis should be used. He wasn't trained as an analyst, but he had very good common sense and I always appreciated that. The other guy that I really liked was Admiral Mike Mullen, who was the first Navy sponsor I reported to when I was doing the SC21 COEA. (He was the deputy in the surface warfare division in OPNAV.) He later became CNO, and I worked with him when he was CNO. Later he was JCS Chairman, but I never worked with him when he was Chairman. He always had great insights. He used to take CNA reports and write "PSM" on the front - "Please see me." When he'd have questions about CNA reports, he called me in. This was when he was N8, and he would call me in for very explicit criticisms of some of the work that CNA was doing. I always appreciated the fact that he would tell it to me directly, but also the fact that he was that interested in

the details of the work we were doing. So he was a good role model for me on the Navy side.

Then I think Dr. Ralph Semmel, who was the Director of the Lab at APL, and also Christine Fox, who was a President of CNA for a time, later the first head of CAPE, and later a senior executive at APL who I managed to convince to come there. Both of them were great what I call “strategic leaders.” They were wonderful at looking at strategic aspects of problems, knowing that they had plenty of people to work with, the technical and tactical issues of the problem. They were very good, what I considered to be “strategic thinkers.” Working with them, I realized that I was never going to be as good a strategic thinker as they were. My level of competence was at the high tactical level on the technical level of work, and I wasn't a strategic level person. I think I retired at about the right level, being a department head in a place like APL or a vice president at a place like CNA, as opposed to being the most senior executive at those sorts of organizations.

Bob Sheldon: Going to go back to your chemistry background, you're probably the most intense chemist that I've seen in my 100 oral history interviews. One of the few other chemists I know offhand is Bruce Powers, also from CNA.

Mark Lewellyn: I worked with Bruce. Bruce was the head of planning at CNA when I decided to take the Marine Corps field assignment. He called me into his office and said, “Mark, you've ruined your career forever.” [*Laughing*]

Bob Sheldon: Most of the people I know in MORS come from strong backgrounds in engineering or physics or math. Were there any times when you looked at studies, where your mindset that came from chemistry helped you to look at problems differently than your friends who were engineers, physicists, or mathematicians?

Mark Lewellyn: I think so. A lot of the problems I looked at were problems that I refer to as “thermodynamic issues.” They involved concentration and rate of reaction issues. If you look at a lot of things, nearly all combat models are based on the size of opposing forces and the rate at which they interact with each other. So a lot of reaction chemistry was very much related to the way opposing military forces interacted. I always thought that was a good way to look at things. There are always at least two sides to any problem. What you were going to do, and what the threat was going to do. That was the one advantage I thought that a chemist had over some of the other folks.

The other thing I mentioned at that earlier MORSS Heritage Session, when I talked about the Marine Corps ration problem I was given at FMFLANT, where I was able to take my knowledge of thermodynamics and go with a physiology book I checked out from the Old Dominion University library, to figure out how many rations a Marine operating in cold weather would need compared to a Marine operating in temperate weather. How many extra calories. I found that it wasn't that much extra, but then I realized "aha" the thing that drives it in Norway is the mountainous terrain, not the cold. So I told the Marines they had to look at mountainous terrain issues to drive their extra ration requirements, not the cold. And they were able to justify an extra thousand calories or so of rations every day, based on the mountainous terrain in north Norway, as opposed to the cold of north Norway. So that was one area where my thermodynamics background came into practice that I'm not sure other people would have been able to see.

Bob Sheldon:

Earlier, you talked about those three books they dropped on you at CNA, and how those helped you get started in operations research. How did your professional reading evolve as you went through your career? What kind of professional reading did you do to keep up with that?

Mark Lewellyn:

I did a lot of the historical reading. One of my beliefs is that if you look at the history of operations, you can learn from that. I still do a lot of historical reading. Right now, I'm reading a book called *January 1973*. A lot of interesting things happened in January of 1973. The Watergate investigation started under Nixon. Nixon started his second term. The peace agreement in North Vietnam was initialed. And the Roe vs Wade decision came down. So I'm reading a book about all the different tensions in the United States that were going on at the time that affected political decision making. I'm always fascinated with books like that. Technically, I always did a lot of reading about other people's work in terms of past studies and things of that sort. It all depends on the issues I was working with at the time. A lot of that would tend to be classified stuff I'd read. I got very fascinated with the area of arms control and nuclear issues, because of some of the work we were involved in at APL that I alluded to. So reading some of that was fascinating work. But I didn't do a lot of technical reading in terms of better ways of doing linear programming or more advanced programs for doing that, or getting involved in Brawler air combat simulation or some of the more advanced modeling that was going on. I didn't do much reading in those areas. But being at a place

like APL or CNA, I got to sit in on a lot of briefings where people were talking about different approaches. I went to a lot of conferences where people talked about different approaches to doing things. The last analytical tool I got fascinated with was bootstrap statistical methods, which were used at CNA in terms of looking at remotely detonated bombs, improvised explosive devices (IEDs), and things of the sort that were being used in Iraq. They were collecting a lot of data with EA-6B electronic warfare aircraft and analyzing the data using bootstrap statistical methods that I thought were fascinating in terms of helping people find IEDs before they blew up. I thought that was interesting. I think I can talk about that without getting classified.

Bob Sheldon: What's been your involvement in professional societies like MORS and INFORMS over the years?

Mark Lewellyn: Very little. I did read issues of INFORMS journals when they came out, and I went to several MORS meetings over the years. I remember going to one at Quantico where a guy from MITRE got up to brief something. I thought, "This is total bullshit. The guy doesn't know what the hell he's talking about." Going to presentations like that, it just sort of turned me off for a long time to what was going on. I think that was a MORS session, but I don't lay that on the foot of MORS. It was the guy giving the briefing that caused me problems. I thought a lot of the sessions I actually went to were of limited value to me personally. That was my experience in my academic career too, that I never got very heavily involved in the American Chemical Society or the American Physical Society, or any of that stuff because a lot of times you go to conferences, and it was just opportunities for professors from different schools to posture against each other. I just thought that was crazy. It goes back to something I'll tell you about my dad. My dad "just" had a master's degree. I think he was a brilliant guy, but he always hated being pushed in universities to get his doctorate. So he finally got an empty box that he put on the shelf and he wrote on the side in magic marker, "Doctorate Material." He said people used to come in and be so impressed by that, and then realized it was an empty box. [*Laughing*] He was a great believer in that your accomplishments and your character were much more important than your academic degrees. I think my father's view affected me probably more than I want to admit, even though I did get a PhD.

Bob Sheldon: Getting back to your Minnesota roots, it sounds like you've lost most of your Minnesota accent.

Mark Lewellyn: I can hear it when I'm taped. I went to a conference for the Coast Guard once, and they said, "Oh, Mark. Everyone always recognizes your voice when you ask a question."

Bob Sheldon: Do you have any parting shots?

Mark Lewellyn: I just wonder if this will be like my thesis, and other than me, only one or two people will read it.

I used to tell people that I enjoyed going to work every day of my career. The problems were interesting and important. The sponsors were first-rate. The organizations I worked for had proud histories. The people I worked with each day were wonderful and committed to doing their best. In short, I had a great career, and there is little about it I would want to change.