



*On the occasion of the 45<sup>th</sup> anniversary of the Military Operations Research Society, we are pleased to present this oral history of Mr. Lewis A. Leake, MORS' first President.*

When I was the Chair of the Heritage Committee in 2006 my main focus was the MORS 40th Anniversary celebration. We compiled photos and highlights of most of the MORS Past Presidents' accomplishments. Regrettably, we were unable to find much information nor a photo of our first MORS President, Lewis A. Leake, FS. We did a full court press to find Lewis. Finally our investigation led to a tip that Lewis was living in St. George, Utah. Dr. Bob Sheldon, FS, and Mike Garrambone, MORS Vice President for Public Affairs, made immediate plans to conduct an oral history telephonic interview on 2 June

2008. After several hours on the phone, we agreed that a follow-on interview would be in order. Months later I was at a friend's wedding in Las Vegas, and subsequently drove to St. George to meet Lewis. On 30 November 2008 I met Lewis, his charming wife Sydney, and grandson David Hilton in St. George. Lewis was very humble about all of the attention he was receiving from MORS after so many years had passed. We conducted the second interview from his home with other Heritage Committee members and President Mike Kwinn participating by telephone. Lewis alertly recalled a surprising amount of detail about events that

occurred a half century ago. He loved to solve problems and believed in striving for perfection in all his endeavors. Lewis died 30 March 2010 at his home in St. George, Utah. He is greatly missed by all who knew him. Meeting and interviewing our first MORS President was an experience I will always fondly remember. Our Society, guided and cultivated by Lewis Leake and his successors, has proven extremely valuable to our MORS members, our sponsors, and more importantly, to our country's security. I hope you enjoy the oral history of our Founding President, Lewis Leake, FS.

—Bill Dunn, FS

## Military Operations Research Society Oral History Project Interview of Mr. Lewis A. Leake, FS

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*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.*

Mr. Lewis Albert Leake, Fellow of the Society (FS), was the first President of the newly created Military Operations Research Society (MORS) chartered 29 April 1966. Mr. Leake was elected President of the Society at the first Board of Directors meeting on 25 April 1966 and served to 1967. In 1991, he was elected a Fellow of the Society. The first interview was conducted via telephone on 2 June 2008, with Mr. Leake in St. George, Utah, Mr.

Garrambone in Dayton, Ohio, and Dr. Sheldon in Alexandria, Virginia. A second interview took place on 30 November 2008. This second interview was led by Mr. Dunn who traveled to St. George to orchestrate this event from Mr. Leake's home in Utah. Mr. Dunn coordinated to have then MORS President, Mike Kwinn, and MORS Heritage Chair, Dr. Steve Pilnick, also participated in this interview via telephone.

**Mike Garrambone:** Mr. Leake, it was very difficult to find you. It seems like over the years you have moved around quite a bit. I understood you to be a very active individual.

**Lewis Leake:** Yes, I was very active until about four years ago when I had a severe stroke. I still remain fairly active, but not as physically active as I used to be.

**Bob Sheldon:** Can you give us your parents' names and tell us how they might have influenced you?

**Lewis Leake:** My father's name was Lewis Albert Leake. I was Junior. He died when I was fifteen years old, so I just dropped the junior. I guess that was technically not right, but I haven't used it since. My mother's maiden name was Margery Angus Walker.

**Mike Garrambone:** What was your mother's profession?

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**Lewis Leake:** Her profession was a wonderful stay-at-home mom. Before she was married she worked for a year in New York City.

There she was a milliner and created high-fashion women's hats. After her children left home she designed and sewed elegant wedding dresses for at least one hundred brides and often the dresses for all of the girls in a wedding party. I think that her cheerful disposition and willingness to try anything (such as taking a ride in my brother's hot air balloon at age 80) had a big impact on me.

**Mike Garrambone:** Where were you born?

**Lewis Leake:** I was born 20 May 1925 in Denver, Colorado.

**Bob Sheldon:** What did your father do for a living?

**Lewis Leake:** My father was a printing press machinist for the American Type Founders Company in Denver. In 1932, he lost his job because of the Depression, so we moved to Salt Lake City, Utah, where he knew he could get work. He installed, repaired, and sold printing presses and related equipment and supplies—all but the paper. As a boy, I worked for him during school vacations and summers.

**Bob Sheldon:** Tell us where you went to grade school, junior high, and high school.

**Lewis Leake:** Almost all in Salt Lake City, except for the very first grades in Denver.

**Bob Sheldon:** Did you take an early interest in math and science?

**Lewis Leake:** After arithmetic, I got to algebra in junior high school and suddenly mathematics became very interesting to me. I enjoyed it from then on. Mathematics was my favorite subject in high school.

**Mike Garrambone:** Where did you go to high school?

**Lewis Leake:** I attended South High

School in Salt Lake City. I graduated in early June 1943.

**Bob Sheldon:** Did you go straight to college?

**Lewis Leake:** During that time we were at war. The Navy and the Army had recruiters come to the high schools and interview students who had any interest in becoming officers. They administered aptitude tests and so forth. I indicated that I wanted to be an aeronautical engineer and I was selected to be in the program that the Navy started on 1 July 1943. It was called the V-12, Naval College Training Program. The V-12 program was to guarantee an officer replacement pool for the Navy and Marines during World War II (WWII) and gave many young men the opportunity to attend college. The program was disbanded at the end of WWII, having trained thousands of students. First they sent me to Butte, Montana—to the Montana School of Mines—for two semesters. Before that time I had enlisted in the Naval Reserve and was on inactive duty and attended the University of Utah for two quarters in pre-engineering courses. I continued to enjoy and excel in mathematics and chemistry and was tempted to change my major to chemistry at that time.

**Bob Sheldon:** What did you do after those two semesters in Montana?

**Lewis Leake:** The Navy sent me to Purdue University in March 1944 where I was able to study aeronautical engineering. That's where I met my future wife, Sydney Anne Tuesburg of La Porte, Indiana.

**Bob Sheldon:** How long did you stay at Purdue?

**Lewis Leake:** I was there until late October 1945.

**Mike Garrambone:** So this was just after the war?

**Lewis Leake:** Victory over Japan (VJ)-Day occurred in August 1945 when I was in my seventh semester. The Navy decided to stop the program and they gave me a commission as an Ensign in November and sent me to the Naval Air Station (NAS), Dallas, Texas.

**Bob Sheldon:** Did you have your degree?

**Lewis Leake:** I didn't have the degree yet. That came after I was later released to inactive duty and I went back to Purdue on the GI Bill.

**Bob Sheldon:** What did you do in the Navy?

**Lewis Leake:** At that time the war was over and they were winding down. We were actually disassembling airplanes at the NAS, Dallas. For example, the F6F and the F4U aircraft were being dismantled there. We were saving some of the parts, and scrapping almost all the rest of the airplane. I was in what was called the Assembly and Repair Department but we were not repairing much.

**Bob Sheldon:** How much time did you spend in Dallas?

**Lewis Leake:** I was there from November 1945 until early June 1946. The Navy sent me for further assignment to COMAIRPAC in Hawaii where I was to be assigned further in the Pacific. It didn't make any sense. I tried to get them to change the orders, but I went to Pearl Harbor anyway. After I got there, the Assignment Officer said, "What did they send you here for?" I said, "That's what I asked for; I had tried to get the orders changed." So he said, "Well, I'll check around and see if anybody wants you. Come back tomorrow." I went back the next day, and he said, "Nobody wants you; we're writing Demobilization Orders for you." I spent about a week or ten days in Hawaii before I could get another ship back. Then my wife had a miscarriage and suddenly they put me on a priority list to be flown back to the mainland.

**Bob Sheldon:** Was she waiting for you at Purdue?

**Lewis Leake:** She was at her mother's home in Northern Indiana.

**Mike Garrambone:** Were you released from active duty when you came back?

**Lewis Leake:** Yes. I came to San Francisco and was released to duty as an Ensign in the Naval Reserve and was active in the Naval Reserve for quite a few years thereafter.

**Mike Garrambone:** So you took up residence in San Francisco?

**Lewis Leake:** No, I got on a train and went back to Indiana to be with my wife.



**Mike Garrambone:** You eventually got your degree in aeronautical engineering?

**Lewis Leake:** Yes. I started that fall and needed to take five hours of course work to finish a Bachelor of Science (BS) degree. I'd taken a lot of advanced courses during my undergraduate work and my professor suggested that I could readily get a Master of Science (MS) degree during the coming school year. Thus, I received my BS in February 1947 and my MS in June 1947, both in aeronautical engineering.

**Mike Garrambone:** That was pretty quick!

**Lewis Leake:** Yes, I took the needed courses in the fall semester, and wrote my thesis and took a few courses in the spring of 1947.

**Bob Sheldon:** What did you write your thesis on?

**Lewis Leake:** We had some former Air Force officers who had been at Purdue the prior year. For their MS degree they had set up a primitive gas turbine apparatus using an aircraft turbo supercharger. I finished some of the needed work, which included learning to weld parts of the improvised test equipment. I ran many tests and then wrote my thesis as an analysis of its performance characteristics. The setup made the equivalent of a crude gas turbine engine. We had a large burner between the output of the compressor and the turbine. It was an extremely inefficient device and would run for only about 30 seconds before overheating the turbine blades.

**Bob Sheldon:** What did you do after you finished your MS degree?

**Lewis Leake:** I went to Boeing's Jet Propulsion Unit in Seattle. I worked on things that were related to gas turbines and ramjets.

**Mike Garrambone:** Were you working on design or were you working on installation or material construction?

**Lewis Leake:** One interesting project had to do with designing and testing diffusers that were to collect the gases in a permanently installed turbine installation. I tried two design concepts. They were fabricated in our shop and I tested them to determine the performance

characteristics of the two. Initially I was surprised at which one was most efficient, but I could later understand why because it had more losses because of boundary layer effects.

Our office was directly across the street from Boeing Field. I vividly recall watching the first XB-47 take off with twenty jet-assist rockets in the aft part of the fuselage. They probably added about 20,000 pounds of thrust to get the aircraft off the short runway. We were given a high sign when takeoff was imminent. During the takeoff roll when those rocket engines were ignited, the aircraft took off at a steep angle. We knew that it had to fly more than 100 miles to Moses Lake, Washington, the nearest airstrip at which it could land. It was a very exciting thing to watch.

**Mike Garrambone:** How long were you in Seattle?

**Lewis Leake:** After about a year and a half, I left to teach at the University of Utah as an instructor in Mechanical Engineering.

**Bob Sheldon:** What classes did you teach?

**Lewis Leake:** I taught Statics, Dynamics, and Strength of Materials. I even taught a course on how to use a slide rule—now very antiquated.

**Bob Sheldon:** Do you still know how to operate a slide rule?

**Lewis Leake:** Sure do.

**Bob Sheldon:** How long did you spend on the faculty at Utah?

**Lewis Leake:** I stayed there just for one school year. It turned out to be a very low paying job. If I had stayed for the second year I would have received \$250 per month. I ended up going to what was then called the Naval Air Missile Test Center at Point Mugu, California. That's forty-five miles up the coast from Santa Monica and below Oxnard, which has now become a fairly good-sized town.

**Bob Sheldon:** What kind of work did you do for the Navy at Point Mugu?

**Lewis Leake:** I was involved in testing missiles and in particular I was initially in a group called the Launcher Division. It had to do with ensuring that launch operations were being conducted safely. I

was the test engineer involved in the first launch of the Sparrow missile from an airplane in the early 1950s.

**Bob Sheldon:** The AIM-7 Sparrow, Aerial Intercept Missile?

**Lewis Leake:** No, but this was its primitive forerunner. It was known as the Sparrow I—a radar beam rider missile designed by the company that was then known as the Sperry Gyroscope Corporation. The first launch was from an F6F Hellcat aircraft, which was outfitted as a drone.

**Bob Sheldon:** What size missile was that Sparrow?

**Lewis Leake:** It was 8 inches in diameter and 12 feet in length. The Sparrow I was the first in a sequence of three design concepts for a radar-guided air-to-air missile. The Sparrow II missile was under development by the Douglas Aircraft Company. It was to be a fully active, self-contained radar-guided missile of the same size as the other Sparrow missiles. It was a bold idea, but far ahead of the technology of that era. I don't think it ever reached the stage of flight testing. The semi-active radar-guided Sparrow III was designed by Raytheon.

**Bob Sheldon:** What time frame was that?

**Lewis Leake:** This would've been starting in about 1949 or 1950. I was at Point Mugu for another fifteen years, until 1964.

**Bob Sheldon:** Do you know if those early Sparrow missiles were used in combat?

**Lewis Leake:** Yes. Raytheon's Sparrow III missile actually went into service as the AIM-7. It was used in Vietnam.

**Bob Sheldon:** What aspect of the test cycle were you involved in? Did you set up the experimental design and go out and collect test data for analysis?

**Lewis Leake:** Yes. However, at this stage of the technology, we were not at the point of doing experimental designs such as your question implies. We were only at the stage of determining the feasibility of design concepts for the earliest guided missiles. There was no such thing yet as a production line and an ability to take samples for testing.

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One example of my work is from the first time a Sparrow I was launched. For safety reasons, that was done

from a ground-based launcher. The first launch attempt was a failure. We had instrumented the missile to measure (through telemetry) shock, vibration, and other parameters. I received an award for my report on the cause of the failure. I determined that the igniter for the rocket motor had induced a shock that caused the failure of the missile's guidance system. None of this, of course, was related to operations research. My interest in that came later.

Another interesting early example of my work was from a test of what was intended to become a naval surface-to-air missile, known as the Lark. It was intended eventually to be launched from naval ships toward incoming attack aircraft. A dummy test missile was designed at Point Mugu to evaluate the design concept for launching the test missiles. The first launch was a failure. Soon after launch, the missile ended up performing almost a cartwheel. We had good telemetry data and movies from which I could analyze what had happened. My report "hit the fan" as far as some people were concerned.

**Bob Sheldon:** What was the cause of the failure?

**Lewis Leake:** I was able to determine that the tail cone of the test missile had buckled. One of the two booster rockets had burned longer than the other. There was a resulting off-center thrust that caved in the thin-skinned tail cone of the test missile. My report was received very poorly, especially by the Russian-born designer of the test missile, who was very senior to me. He had convinced key people that my report was in error. A few weeks later a diver found the wreckage on the floor of the ocean a few hundred yards away from the launcher site. The tail cone had in fact caved in.

**Mike Garrambone:** That must have felt pretty good to know that you had figured that out.

**Lewis Leake:** Yes. I knew what had happened. I didn't have any doubt whatever, but now there was the supporting evidence.

**Bob Sheldon:** Did you have large sample sizes of test data to do statistical analysis?

**Lewis Leake:** No. As I mentioned earlier, at that time it was premature. Nothing was even in production yet. The fact is that we were taking relevant courses about statistical design of experiments, statistics, and probability under the auspices of UCLA, but application thereof didn't come during my time in missile testing.

**Mike Garrambone:** You were at Point Mugu until 1964, and we know that MORS came into being in 1966, so I'm beginning to wonder how your interest in MORS began?

**Lewis Leake:** I don't know if you ever heard of men named Royal Weller or Harold Gumbel. Dr. Royal Weller was the Chief Scientist at the Naval Air Missile Test Center which later became the Pacific Missile Range. I was working for Harold Gumbel in the Operations Research Group. Harold became involved in the very earliest phases of the MORS meetings. They were called Military Operations Research Symposia at that time; when MORS was incorporated, it came to stand for the Military Operations Research Society. I don't remember just how Harold got started, but he was involved therein. He became convinced that a lot of operations research was being done in different branches of the military and there was no interplay between the different groups. He felt there ought to be something considered in the way of symposia as a start for some cross talk between the different elements of the military. I think that he and Dr. Weller were in part responsible for getting something going.

**Mike Garrambone:** It sounds like he encouraged you to get involved?

**Lewis Leake:** He did. I recall one of my earliest Symposia (7<sup>th</sup> MORS) was in Seattle at the Boeing Aerospace Division. As an aside, while we were on our way to

Seattle on a Navy C-47, we were told that the Bay of Pigs assault had occurred. That was in April 1961.

**Bob Sheldon:** Can you tell us about that 7<sup>th</sup> MORS Symposium? Did you give any briefings or do you recall sitting in on any briefings and what their topics were?

**Lewis Leake:** I did not present there, but I do recall one very interesting paper. This goes way back to the time that we had the Air Defense Command and interceptor aircraft on alert at air bases around the perimeter of the country. We had the Oxnard Air Force Base close to where we lived in California. Interceptors at these bases were ready to scramble if Soviet bombers were detected coming in. One operational question had to do with where the interceptors might be able to land after performing their missions. At each base there was a meteorologist who was supposed to make hourly weather forecasts into the next few hours to estimate whether the field would be open to recover the interceptors. Statistical analyses were presented in that symposium that showed that you could have predicted whether the fields would be open for landings two or three hours ahead just as well by flipping a coin, based on weather statistics for that location. So, a lot of money was being spent on this forecasting system that wasn't of operational value.

**Mike Garrambone:** Were the symposia large back then? Were they classified?

**Lewis Leake:** Yes, I think about one hundred people attended these and they were classified.

**Mike Garrambone:** Did Harold Gumbel attend with you or did he just send folks that worked for him?

**Lewis Leake:** I am sure that he was there. He was a strong supporter of his analysts going to the symposia. Because MORS was in development, he wanted me to become a member of what was then called the Steering Committee. It was made up of mostly people on the West Coast. In fact, initially it was entirely from people on the West Coast.

**Bill Dunn:** And originally, it was all Navy folks then too?

**Lewis Leake:** Yes, as I recall.



**Bob Sheldon:** When did Air Force and other Service folks start attending the MORS Symposia?

**Lewis Leake:** I think at least a few from the Air Force attended the 1961 meetings in Seattle. However, I suspect that there were more from the other Services at the following symposia.

When I got your call about an oral history interview, I wrote a note to Harold Gumbel and he sent me a letter. He said that his old files of that era were inaccessible at the time, but he sent some of his recollections. I can quote a little bit from his letter.

“Our work on Guided Missile Evaluation had raised many operational questions. In pursuing these, I became aware that every military service department in the DoD did their own OR analysis. It was highly duplicative and in ignorance of what the other services were doing. That is, folks were in complete ignorance of what the other Services were doing around them. Because I was a member of the Operations Research Society of America, I thought that the work of similar organizations would be highly useful to those in the DoD, respecting of course the classified nature of said analyses. I mentioned my concerns to Royal Weller, the Chief Scientist.”

That brought it to the attention of people in the Office of Naval Research (ONR) and they began to sponsor the symposia. James Garvey was part of this; you probably know of him.

**Bob Sheldon:** Yes, I've heard his name many times.

**Lewis Leake:** I don't know any details at this point. I just know that James Garvey ended up being the person in ONR who became the focal point for sponsoring the symposia for a time. It came to the point where it was decided that it was important that ONR not be the sponsor anymore. They wanted an organization to be formed officially to continue the symposia.

**Mike Garrambone:** It seems like you were encouraged to attend and it sounded like your boss wanted you to get into some of the administrative parts as well.

Were there others with you that were driving the ship or interested in forming a society?

**Lewis Leake:** Yes, I think that most of the people who had become involved in the Steering Committee and others felt that it was important to continue to do so. Up to that point membership on the Steering Committee had been through a very informal process. When the ONR wanted to bow out and have it become a professional society, we were among those interested. There were around 20 to 25 participants then.

**Bob Sheldon:** You were President of MORS in 1966 when they incorporated. Tell us more about how you got elected President.

**Lewis Leake:** Preparations had been made to form the Military Operations Research Society. There were two strong-willed key candidates for being the first President. I guess it would be appropriate to say that they were somewhat controversial. I don't remember their names at this point, but I'm sure they had considerably more experience in military operations research than I did. Someone nominated me from the floor and to my surprise I was elected President. I had not near the extent of experience in military OR that the others had. I have always thought my nomination and being elected was because I was the “peace candidate.”

**Bob Sheldon:** We call the original MORS Directors from 1966 the “Founding Directors.” Are there any of these folks you can comment on?

**Lewis Leake:** I remember Clay (Clayton) Thomas very well. He was the Air Force sponsor's representative. He was an analyst and was really one of the people who were quite responsible early on for helping to form MORS in my opinion. Jack Borsting was another. He was at the Naval Postgraduate School in Monterey. Martin Chase was a strong and cheery person. Art Stein from Cornell University was very helpful. Robert Miller was the Secretary/Treasurer when Howard Berger was our Vice President. Vance Wanner was our administrator. He was the man who did all the leg work.

**Bob Sheldon:** We have an award named after him: the Vance Wanner Award.

**Lewis Leake:** Yes, it came about because he died not long after we formed MORS and this was a tribute to his key role in getting us started.

**Mike Garrambone:** Where was the MORS office located?

**Lewis Leake:** It was in Alexandria, Virginia.

**Mike Garrambone:** Did you run a symposium that year as President?

**Lewis Leake:** No. I chaired the 14<sup>th</sup> MORS Symposium in San Diego in 1964. But it was Dr. Dan Howland of Ohio State University who ran the symposium in May of 1966. He was the chair of the 17<sup>th</sup> MORS Symposium held at the Naval Postgraduate School in Monterey.

**Mike Garrambone:** Did they charge in those days to come to the symposia?

**Lewis Leake:** No. There was no charge at all.

**Bob Sheldon:** Did much change in the symposia when MORS was incorporated or did things more or less continue as they had been before?

**Lewis Leake:** It was initially quite similar to before. We continued the expansion that was begun from previous symposia like the early one in Norfolk.

**Mike Garrambone:** Did it seem risky to become incorporated?

**Lewis Leake:** It did not. It didn't seem risky at all.

**Mike Garrambone:** Did you have different working groups? It sounds like you were bringing the Army and the Air Force in with the Navy folks.

**Lewis Leake:** Yes, we did have working groups back then. They were on Command and Control, Special Warfare, Arms Control, Theory of Combat, and a host of other topics. We had already had our first national-level meeting, at Fort Monroe, Virginia, which included people associated with all the Services.

**Mike Garrambone:** I was noticing that some of those titles remain today. We have people that are looking at problems for different services or from different areas like Air Defense or Counter-Air. It seems like you were interested in the same

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things and especially Command and Control. How did the topics come up?  
**Lewis Leake:** People had expressed their interests and then action was taken

accordingly. Those who were working in different establishments probably initiated having the subject of these meetings at their location.

**Mike Garrambone:** We would welcome any photos you have of early MORS activities because we don't have any photos of those early symposia.

**Lewis Leake:** At that time I don't think many records were being kept except by individuals. I don't remember any photos of that period. There was no publication of the proceedings then either.

**Bob Sheldon:** Were you surprised to see MORS grow consistently year after year?

**Lewis Leake:** No. It seemed to have a very valuable purpose and a lot of interest. I remember the growth of the attendance became amazing in terms of how it started.

**Mike Garrambone:** In the early days you used to do symposia twice a year. Today, it takes us all year to plan between each one. I can't imagine the pressure of trying to do two in a year.

**Lewis Leake:** It didn't seem like an extra burden then.

**Mike Garrambone:** But having to find a larger location each time could be. We've had difficulty finding locations for symposia.

**Lewis Leake:** Yes, I can understand that.

**Bill Dunn:** The Operations Research Society of America was founded around 1952 and I was curious if you had any involvement in that?

**Lewis Leake:** I was not much involved, although I was a member. Some of the members of the original committee were members and in fact Harold Gumbel who had been my boss at Point Mugu, California, was hoping to be able to make

some kind of marriage between the two. But the fact that MORS was a classified symposium was a key factor that was not relevant to ORSA. So it was not feasible for ONR to even begin to sponsor ORSA.

**Mike Garrambone:** How long did you stay on the Board?

**Lewis Leake:** As a Past President I was on for one year after my term. I don't remember how long I stayed thereafter, although I did continue attending symposia for a while.

**Bob Sheldon:** Did you ever study the participants that attended the MORS? It seemed like they were either from the West Coast in California or from the East Coast around Washington, D.C. Was there any difference in the attitudes of the analysts from those different geographic regions?

**Lewis Leake:** I can't remember anything of that nature, any generalization.

**Mike Garrambone:** Do you agree with Bob's premise that it was bimodal, East Coast and West Coast, not so many in the middle?

**Lewis Leake:** I think that's true because of the kinds of organizations that were involved. We didn't have a whole lot of people in the Midwest, for example, working these kinds of problems.

**Mike Garrambone:** When you were President and you had the first Board of Directors, was it hard to get people to sign up to compete to be on the Board or were there lots of people that were clamoring to do this?

**Lewis Leake:** They just gravitated as far as I was concerned. People would invite cohorts or friends perhaps, people that they respected to get involved in MORS, and then it just started growing naturally from that.

**Mike Garrambone:** Did you go to other organizations or other "think tanks" to promote what you all were doing at MORS?

**Lewis Leake:** Not in the sense that question implies. The people who were professionals in those organizations who participated were probably recommended by their peers to get involved. That's the way I got involved.

**Mike Garrambone:** Today we interface with the seven MORS sponsors, all the Services, and several Departments. We talk to the various schools and at the same time work with all the think tank organizations like the Center for Army Analysis (CAA), the Center for Navy Analyses (CNA), or our Pentagon folks. I'm not sure if you did that or had to do that back in the days?

**Lewis Leake:** People in organizations like that were members, or participants, and tended to even be on the Board or the early Steering Committee. They were not there as official representatives of their organizations—they were there because it was their career interest.

**Bob Sheldon:** The record shows you dropping off sometime after being Past President. We know you attended the 3<sup>rd</sup> MORSS in 1958 and stayed active with the Society through 1966 when MORS was incorporated.

**Lewis Leake:** Yes, I recall being on the Steering Committee for about a year and a half before the impetus for MORS becoming a national society began.

**Mike Garrambone:** I don't suppose you've been back to a symposium in a while?

**Lewis Leake:** No, I couldn't even get in. It's been a long time since I had a clearance. And it wouldn't be very feasible for me. I don't get around very well after my stroke in 2004.

**Mike Garrambone:** Going back to your job assignments, where were you after Point Mugu in 1964?

**Lewis Leake:** Well, in 1964 I decided to change my employment and became convinced that it would be more interesting to work in Washington, DC, and not out at a test range. I interviewed at the Operations Evaluation Group (OEG) and the Research Analysis Corporation. RAC was the Army's group that was the equivalent of OEG at the CNA.

**Mike Garrambone:** Which one did you choose, and when?

**Lewis Leake:** I went to RAC in June or July of 1964.

**Bob Sheldon:** Where was RAC located at the time?



**Lewis Leake:** In McLean, VA.

**Bob Sheldon:** How long did you work for RAC?

**Lewis Leake:** I worked for RAC from 1964 until 1971.

**Bob Sheldon:** So you were working for them while you were President of MORS?

**Lewis Leake:** Yes.

**Mike Garrambone:** What types of projects did you have?

**Lewis Leake:** The first project was under a man named Bob Gessert. We were commissioned by the Arms Control and Disarmament Agency (ACDA) to study the feasibility of monitoring compliance with a proposed nuclear weapons freeze in Germany, East Germany, and Poland. This was a careful analysis basically to determine whether was possible to assess whether or not the Soviets might be able to secretly transport nuclear weapons into the area. We were to analyze the feasibility of establishing an inspection system for all items being imported into that zone. We postulated possible inspection systems for all forms of transport from the USSR into Poland and East Germany. That included, for example, means of radiometric inspections of a large amount of rail traffic passing through transloading stations on the border between the USSR and Poland. Those stations were in place because wider gauge railway tracks prevailed in the USSR.

One of the most interesting studies in which I participated in at RAC resulted in a paper that I wrote entitled "A Method for Evaluating the Combat Effectiveness of a Tactical Information System in a Field Army." It won the prize as the best paper given at the 24<sup>th</sup> MORS Symposium in New London, Connecticut.

At the time, some people in the Army wanted to use computers to improve the flow of tactical information to and within Army headquarters units. You can hardly imagine how bad the situation was back in the 1960s and before. Conditions were little, if any, better than during WWII.

Communications to and within staffs had changed little. Reports from forward units, aircraft, advanced patrols, and the

like were generally received by radio and the results often handwritten for delivery to key staff officers.

In the process and under the press of time, important information often might get buried in a stack of papers or otherwise delayed. The importance of key items might not be appreciated by those involved. The desire of some in the Army was to develop means to use computers to help speed the flow of information between and within headquarters. But many in the Army thought it was more important to buy tanks and other combat equipment than to use limited funds to buy computer systems.

We were commissioned to do a study to find out whether or not the introduction of a Tactical Information System into the Army would pay off. Dr. Roland V. Tiede was the director of the study. He had been an artillery officer in combat in France and Germany. He reasoned that the best way to approach the question was through a series of wargames in which officers with experience in leading field forces in Europe would participate. The wargames were designed to have an appearance of reality in the flow of information from forward units, patrol aircraft, and the other sources. Communications were delayed as they were typically in the old manual system, and as postulated, they could be improved with the new envisioned system.

My principal part involved extensive study about the actual delays that had been experienced during combat. At that time, there was still a large amount of data available from actual staff records from units in combat in the European theater in WWII. As I mentioned earlier, it was amazing to see how key tactical information was often greatly delayed in getting to combat commanders. People on a staff might have key information but it wouldn't always get to the right people on the staff or it might get screened out. So the actual delay from the time that information went into a headquarters didn't have much to do with when it came to the attention of those who made decisions; it was highly variable.



Thus, I was able to characterize statistically those delays from a lot of good WWII historical data. At the time of our study, there was not much difference between the conditions that had existed during the war. During our wargames, we randomly imposed the kind of delays that were typical for forces not having the information speedups of a new data system. Then we also introduced the information delay estimates for a reasonably good Tactical Information System—one that got the information to the commanders much faster. We then ran a lot of wargames wherein the blue forces experienced information delays with and without the improved data system. The red force commanders were never provided the information speedups of a new data system. Theirs were characterized by the typical information delays that our forces had experienced during WWII. We were able to determine that having a new Tactical Information System was worth approximately the equivalent of adding one battalion to a division-level force. That force had nine combat battalions with all their infantry, tanks, artillery, and so forth. That is, the Tactical Information System was of equal value, in a sense, to adding another whole battalion to an Army division.

**Mike Garrambone:** Wow, that's quite a comparison and it uses measures commanders can fully relate to.

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**Lewis Leake:** It was not accurate, not precise by any means, but nevertheless, it was deemed significant, at least in some quarters.

**Bob Sheldon:** Can you point to decisions that the Army made for acquisition of the Tactical Information System that your analysis contributed to?

**Lewis Leake:** I do not know what actually ended up happening as any direct response to our study. I think that the advances that we might have gained from the primitive system under development in the mid 1960s have been dwarfed by the availability of new technology and the increased technical savvy of Army personnel.

**Mike Garrambone:** I assume this paper was classified?

**Lewis Leake:** No. It appeared in the *ORSA Journal* in the May–June 1970 issue, now available through Journal Storage (JSTOR).

**Bill Dunn:** I have a question sent by Gene Visco, FS. Gene wants to know what do you recall as the most significant study, or studies, that you participated in while at RAC?

**Lewis Leake:** One of the studies in which I participated took place during the Vietnam War. U.S. forces had made an incursion into Cambodia and overran Viet Cong (VC) listening posts. As a result, highest levels of command, up to the Joint Chiefs of Staff, became acquainted with what the Army Security Agency and likely the Defense Intelligence Agency (DIA) already knew. That is, it was very easy to exploit our tactical communications. At that time our forces were principally using unencrypted radios and rarely, if ever, changing call signs. Encrypted tactical radios were only beginning to be introduced into the forces. Ships had used the same call sign for years, I guess forever. Aircraft squadrons and other units typically had macho call signs that they didn't want to give up. The VC were easily reading our communications and knew what we were planning the night before combat actions.

At RAC, the group I was in was already engaged in a study to develop

feasible means for Army units to make daily changes in their call signs and their assigned tactical frequencies. We were given the task to study how to do similar things in all tactical forces. This study included the assignment to go to Army, Navy, Air Force and Marine headquarters units in South Vietnam, Thailand, the Philippines, Okinawa, and elsewhere. We also went aboard an aircraft carrier and the Navy's flagship on Yankee Station off the coast of Vietnam, and to other regions of the world.

We interviewed personnel at many levels of command and even at tactical outposts. That included pilots who had just returned from combat missions over North Vietnam. Partially through those interviews, we tried to assess how various potential changes in call signs and frequencies might be feasible to provide improved tactical security for our forces. We discussed possible changes and the impact they might have on their operations. Our final report was well received and we understand that changes were being made, somewhat along the lines we recommended. However, we had nothing to do with such implementations and I know nothing specifically about what eventually happened.

**Mike Garrambone:** How long did you get to work on studies like that one?

**Lewis Leake:** At that time this study was all of a sudden, but it lasted actually eight months.

**Bill Dunn:** Did you have a lot of interaction with the sponsor for the study? Were there frequent meetings and in-process reviews or were you pretty much told "Go away and do this and come back when it's through"?

**Lewis Leake:** We had a representative from DIA with us on our trips through much of this time. We were working closely with him, but when we finished the trip we did the analysis and put the final report together.

**Mike Garrambone:** It sounds like RAC had a very large purview back then. Would you say that it was the major study agency for the Army at the time?

**Lewis Leake:** Yes, it had been, but the conditions that led to its eventual

sale had been brewing for years. RAC had been formed as a follow on to the Operations Research Office (ORO) for the Army, which began in about 1948 under contract with the Johns Hopkins University. ORO was headed by Dr. Ellis Johnson, a scientist who had much relevant experience during WWII. His independent style aroused the ire of key Army leaders. In 1961 they brought about the transfer of the work and personnel to RAC, which had been newly formed as a Federal Contract Research Center, in effect a sister to the RAND Corporation, CNA, and the Institute for Defense Analyses (IDA).

Frank Parker became the president of the newly formed RAC. During the ensuing 12 to 13 years RAC was involved in a very wide diversity of studies. I'll give only a very few examples.

One was the design of military force structures, groupings of military units, to execute given missions in the most cost-effective manner. This required handling complicated arrays of data with manifold flexibility and interrelationships bearing on cost, effectiveness, deployment ability, and flexibility. Other tasks lay in the field of manpower where the Army asked RAC to help answer questions arising from the draft, its size and needs and capabilities to provide appropriate quantities of the right kind of manpower.

As time went on, there was much diversity in the nature of the studies performed by RAC. For example, there were studies of the nature and purposes of insurgency, counterinsurgency, and operations undertaken to stabilize societies under threat. This included examining the political and military aspects of regions where US-led forces were already operating or providing training. The studies considered both current and projected environments. Field offices were set up to study problems on the scene and provide the support and direct conjunction with local tests and local operations.

Much work involved the assessment of weapons requirements and of the comparative effectiveness of competing weapons systems. As I mentioned, there



were studies of military communications and proposing new ways to allocate radio frequencies and improve the dependability of communications nets. Other work encompassed helping the Army deal with emerging threats.

I have covered only a sample of the work of RAC. Some of this was in part taken from a publication entitled *The Research Analysis Corporation, a History of a Federal Contract Research Center* by Charles A.H. Thomson, published in June 1975, Library of Congress catalog card number 75-18909.

**Bob Sheldon:** Where did you go to from RAC in 1971?

**Lewis Leake:** At that time the future of RAC was up in the air. RAC was soon sold to the General Research Corporation. Before that occurred, Clive Whittenbury was a Vice President at RAC; he was one of my mentors. As the sale was imminent, he took a group of us with him to Science Applications Incorporated (SAI) with headquarters in La Jolla, California. We set up an office in Virginia. The name was later changed to the Science Applications International Corporation (SAIC). There were around fifteen of us in that early group that left RAC.

**Bob Sheldon:** What other projects did you work on for SAI/SAIC?

**Lewis Leake:** There were lots of them. One study pertained to a possible treaty to control (or abandon) all weapons of mass destruction—nuclear, chemical, or biological. It was interesting that my first studies at both RAC and SAI involved arms control issues.

Another one of my early tasks was to study potential threats to our ballistic missile submarine (SSBN) fleet. The Applied Physics Lab at Johns Hopkins University had a contract to research any technical means that might enable detecting submarines. Those means included, for example, (1) improved airborne magnetic anomaly detectors (MAD), (2) improved sonar sensors and detection algorithms, (3) an ability to use imaging techniques to detect the wake of a submerged submarine on the ocean's surface, and (4) any other physical means

by which submarines might be detected. We evaluated whether advanced sensors on platforms such as patrol aircraft, satellites, fixed buoys, and other systems might pose an economically feasible threat to our SSBN fleet. As one example, we evaluated new capabilities of MAD gear on a fleet of long-range patrol aircraft. In each case we would postulate a force and operations that might be used for doing the job. Thus, different kinds of sensor platforms and types of sensors were evaluated. One of our reports ended up being classified so we couldn't read it anymore.

**Bob Sheldon:** Did you continue your involvement in MORS after you went to SAIC?

**Lewis Leake:** I don't think so, except tangentially. I transferred within SAIC from Virginia to Denver in 1978, to the Foreign System Research Center. The head of the office was John Battilega. John ended up being one of the Directors of MORS. Judy Grange became his deputy and she too became a member of the MORS Board of Directors. I ended up doing a lot of work at Wright-Patterson Air Force Base in Ohio.

**Mike Garrambone:** So you would have to frequently fly from Denver to Dayton for project meetings?

**Lewis Leake:** I actually worked in Dayton for weeks at a time during our studies where we were evaluating possible threats.

**Mike Garrambone:** You had been doing a lot of Army work and now you were switching over to Air Force?

**Lewis Leake:** That's true to a degree, but the orientation was not Air Force individually. Our work evolved to analyzing how the Soviets thought and how they reacted to what we did. I described this as a global chess game.

**Mike Garrambone:** Were you a big-time computer user?

**Lewis Leake:** No. I used them, but not big-time at all. Actually in some of my work, when the small, powerful hand-held calculators started becoming available, I did a lot of the work with those. They were very valuable. I used them for a number of studies. I was never heavily involved in computers.



**Mike Garrambone:** This was in 1978.

**Lewis Leake:** Yes. From 1978 until 1987, I was working in Denver.

**Bill Dunn:** After all this time, what do you feel are the important precursors, either education or military experience or whatever, to make a good military operations analyst?

**Lewis Leake:** It seems to me that some people have an innate ability to think about problems in a rational way, not necessarily associated with the amount of schooling they've had.

**Mike Garrambone:** So there's kind of an art to it?

**Lewis Leake:** Yes.

**Mike Garrambone:** Do you remember any pressures or deadlines to get your studies done?

**Lewis Leake:** There was frequently a lot of pressure to get the final report done on time, of course.

**Mike Garrambone:** You had to do lots of briefings?

**Lewis Leake:** We gave lots of briefings. We made view graphs back then.

**Mike Garrambone:** It seems like you were doing a lot of work over that period of time. Was it enjoyable?

**Lewis Leake:** It was very interesting work. My wife was amazed when I decided to retire.

**Mike Garrambone:** So you retired in 1987?

**Lewis Leake:** Yes, in late 1987.

**Mike Garrambone:** Did you stay in Denver when you retired or is that when you moved to Utah?

**Lewis Leake:** Actually I began to serve missions with my wife for the Church of

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Jesus Christ of Latter-day Saints (LDS), which has the nickname, the Mormon Church. We started serving missions in January 1988 after a trip to Guatemala and Southern Mexico and a company paid retirement gift of a trip to Egypt and Israel.

**Bob Sheldon:** Which countries did you go to on your missions?

**Lewis Leake:** We first went for a year and a half to the Singapore Mission, which included nine months in India, three in Malaysia, and about two months in Indonesia. After that mission, we went to Spain three times, each time for a year and a half, first to the Canary Islands and then to Barcelona including Valencia and then to the Bilbao mission including service in La Coruna and Leon in Northern Spain.

We also served in Salt Lake City in the Family History Library of the Church (the Genealogy Library) for another year and a half where we were teaching and helping patrons as they came in for help. The last mission was for the same duration at our LDS Temple in Lima, Peru. There I had the privilege of being one of the two counselors in the Temple Presidency.

**Mike Garrambone:** That's quite a few missions.

**Lewis Leake:** Six in all.

**Mike Garrambone:** I thought the average for a volunteer was one mission?

**Lewis Leake:** For a lot of people it is, but we were in very good health, had the needed funds to pay our way, and the enthusiastic support of our family.

**Bob Sheldon:** Have you done your own genealogy?

**Lewis Leake:** Yes. I have one line that goes back to around 1100 A.D. in Sweden. That's the only one that's anywhere near that far back.

**Mike Garrambone:** How long have you been studying genealogy?

**Lewis Leake:** I have worked on genealogy since 1949 when I started collecting information from our extended family lines. It is far easier to do now using computers. Genealogy is actually one of the primary uses now of the Web—after pornography.

My source on that is perhaps eight years old.

**Bill Dunn:** Are you still doing genealogy work?

**Lewis Leake:** Not very much anymore. Our kids are still doing it.

**Bill Dunn:** Salt Lake City is certainly one of the key places in the world to do genealogy.

**Lewis Leake:** Oh, yes. That was very interesting to be there and have people come from all over the world to get help.

**Bill Dunn:** Does having that experience as a researcher and military analyst help when you're searching back through genealogy trying to come up with some of the nuggets to find out who was where?

**Lewis Leake:** I suppose it's the analytical frame of mind. It did help. I had success in some of my genealogy endeavors as a result of a lot of research.

**Mike Garrambone:** What if you were trying to make some more analysts today? What would you want to do with those folks to get them to do well in their new profession?

**Lewis Leake:** I think a lot of the universities do an excellent job in that regard with getting the students projects to work on, doing teams that design all kinds of things. I'm sure the same could be done in an operations research

type curriculum; just give them good problems, real-life problems to work on. Getting out and working with companies and groups that are actually doing operations research type studies and then learning from this. Young people can really get their teeth into it that way and begin to understand what's going on.

**Mike Garrambone:** MORS is always looking for ways to educate analysts. You might have done some sort of training in your day. Did they all come trained or did you help them out along the way?

**Lewis Leake:** I don't remember any attention to that focus during my time in MORS.

**Mike Garrambone:** So you already had all the pros?

**Lewis Leake:** That was part of it. Of course, essentially none of the pros were trained in operations research in the beginning. Early operations research people came out of different experiences. It just had to do with their mental outlook, their mindset, their ability to grasp concepts, and at a large scale rather than at the nuts and bolts level.

**Bill Dunn:** Do you have any other thoughts you'd like to express here in your history?

**Lewis Leake:** I'd just say, "Keep up the good work."

**Mike Garrambone:** It is because of people like you that we even have a society and we really appreciate all the efforts that you and our other predecessors did.

**Lewis Leake:** One thing I'd like to say is I don't feel like I was really a key at all. There were lots of people in those early times that were getting things going.

