John E. Shepherd Interview (MORS)

Shepherd, John E.

Military Operations Research Society (MORS) Oral History Project Interview of Mr. John E. Shepherd

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MILITARY OPS RESEARCH HERITAGE ARTICLE

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.

Mr. John E. Shepherd was the Special Advisor for Modeling at the Center for Army Analysis. The interview was conducted on October 14, 2011 with Mr. John Shepherd and Dr. Bob Sheldon, FS, in Fairfax, Virginia; participating via telephone were Mr. Bill Dunn, FS, and Mr. Mike Garrambone.

Bob Sheldon: This is a MORS Oral History interview with John Shepherd, and we're here in Fairfax, Virginia on October 14, 2011. John, first of all, tell me your parents' names.

John Shepherd: My parents' names were Elizabeth and Harry Shepherd.

Bob Sheldon: Tell us a little bit about your parents and how they influenced you.

John Shepherd: My mother was an only child. She attended a New England college—I don't recall the name. She was an artist and worked for Johns Hopkins University Medical School where she did illustrations of surgery for textbooks. She told me photography back in the early 1930s was pretty bad, and the surgeons always wanted the clamps in a different place than they really would have them, so she did color drawings for textbooks.

My father worked for Scripps Howard newspaper syndicate and for the *Baltimore Sun*, and that's how they met.

I don't know that they ever pushed me in any direction. My mother was very much into art, so when I was six years old I took tap and ballet and started to play the trumpet and the piano. My brother and sister went through the same. When I was about seven, my parents decided to get a divorce so I was shipped off to Augusta Military Academy, where my mother assured me I would learn things that would serve me well in my life; and I did. I learned how to take an M-1 Garand rifle apart and put it back together while blindfolded in less than four minutes. I wrote my mother and told her this. She wrote me back and cautioned me about sarcasms.

Bill Dunn: Where is Augusta Military Academy?

John Shepherd: It's in Fort Defiance, Virginia. It's between Harrisonburg and Stanton, Virginia. I played trumpet in the band company. Everyone wanted to be in the band company because they practiced in a large room while the rest of the corps marched from about 3:00 until 4:00 p.m. I was constantly teaching people how to read music and play musical instruments; many of the instruments I had never played. Even the band instructor couldn't read music. He was hired as a faculty member to teach English, but his secondary job was standing in front of us with a baton and waving it back and forth.

Bob Sheldon: Did you ever tell E. B. Vandiver you knew how to tap dance?

John Shepherd: No.

Bill Dunn: And ballet.

John Shepherd: And ballet. All I remember was, "Shuffle, shuffle, click, shuffle, shuffle, click." These are movements you make with your feet. It's better when you're six. If you're eight or nine, you're the only guy in the class with a bunch of eight- or nine-year-old girls; it's humiliating.

How did that influence me to go into mathematics and chemistry? I don't know.

Bob Sheldon: What years did you attend the Augusta Military Academy?

John Shepherd: Probably third and fourth grades. I was there two years. I don't remember a lot about it except it was where I became interested in amateur radio. They had military radios, walkie-talkies, and I was fascinated with them; I learned to take them apart and put them together, and fix them, and calibrate them. That may have influenced me later in life understanding electronics. I think when I was 11 or 12, I did pass the Federal Communications Commission (FCC) exam to get my general class amateur radio license.

My mother remarried and we moved to a small town in the Ozarks, not far from where Mr. Vandiver grew up, believe it or not—Cabool, Missouri—where I would run my amateur radio station. Television (TV) had just come in. We were 75 miles from the local transmitter and we had the only TV set in town. The three doctors in town lived on either side of us and across the street, and they'd come over and watch television, particularly baseball games. After one of the docs purchased his TV set, I was prohibited from using my radio

transmitter during baseball games because the signal would wipe out the TV reception.

When my mother later divorced, I came east to live with my grandparents and attended Annandale High School in Virginia. My classmates included Creighton Abrams Jr.; Jay Scully, who later became Assistant Secretary of the Army for Research, Development and Acquisition; and Jim Clapper. Jim was dating the lady who later became and has been my wife for the past 50 years. Jim, like so many military dependents, moved when his father was transferred. As chance would have it, I met Jim's father many years later in a meeting at Arlington Hall.

Bill Dunn: That's Lieutenant General Clapper you're talking about?

John Shepherd: Yes. The irony of the whole thing is many years later my wife was sitting on a bus from CIA headquarters to an office in Rosslyn, Virginia. Two women seated next to her were talking about General Clapper. My wife commented she had gone steady with Jim in high school.

This story gets even better because when Jim returned to his office at Bolling Air Force Base in Washington, DC, one of these women who was a secretary said, ''Oh, we ran into your high school sweetheart,'' whereupon the story goes, he retrieved his high school yearbook and the secretary said, ''She hasn't changed a bit.'' So Jim called—or his secretary called—my wife on Monday and said, ''General Clapper would like to take you to lunch,'' and my wife said, ''Well, you tell General Clapper if he wants to take me to lunch, he should call me.'' About 10 minutes later he called—he was laughing—and they did go to lunch.

Bob Sheldon: Did you take a lot of math and science courses in Annandale High School?

John Shepherd: I did. I took most of what they offered. One of the interesting stories is one of my classmates, Creighton Abrams Jr., was in my Algebra II class, and the instructor—I think Mr. Eckles was his name—stopped me in the hall one day and said, ''Abrams' dad was up here. He's a one-star general and he's complaining that we're not getting enough homework in algebra and I don't know what to do.'' I said, ''It's very simple: you let Abrams work all the problems at the end of every chapter, and the rest of us will continue to work the even or the odd, whatever you want.'' So I said over the years, if Creighton was any good in math, it was my fault.

Bob Sheldon: What year did you graduate from Annandale?

John Shepherd: 1958.

Bob Sheldon: Where did you go to college?

John Shepherd: I had some scholarship offers, but they were all the land-grant schools. In those days, you had to go in the Corps of Cadets for the first two years. Virginia Military Institute (VMI) came after me pretty hard; some admiral who graduated from there drove me down to Lexington, Virginia. They wanted a basketball player, which I had been in high school but I wasn't that good. My high school assistant principal had graduated from a small college in Eastern Kentucky called Union College, and he said, ''I'm going to go down there and do a little fishing this summer. Why don't you go with me and let's look it over?'' It was perfect. Twelve hundred students, small campus, I loved it.

Bob Sheldon: What was your major?

John Shepherd: Math and a minor in chemistry—I almost had a major in chemistry. I think I had a minor in theology. Now that may sound strange, but theology and philosophy fascinated me. I wandered off and took a lot of courses in theology and discovered that perhaps much of theology is predicated on some fairly weak evidence, which when you're young can really challenge your beliefs. You really have to be careful and have somebody, a good professor, who can help you get back on track. I loved chemistry. It's just the labs were forever and ever.

Bill Dunn: Let me clarify something. You went to Union College, or you went to Eastern Kentucky University?

John Shepherd: Union College. We played Eastern Kentucky—Eastern was one of our basketball rivals.

Bob Sheldon: Did you play basketball at Union College?

John Shepherd: A little bit, but never varsity.

Bob Sheldon: You had a math major; I assume you took the standard array of abstract math and matrix algebra and differential equations?

John Shepherd: Yes, calculus, differential equations, vector and tensor analysis, dot and

cross products; I loved it. I guess there were 10 hours of calculus. I took four hours of differential equations. Theory of equations was a course I never quite understood.

Bob Sheldon: What was your first job after graduation?

John Shepherd: I'd broken my left arm. I was actually going to go in the Navy and become a pilot, but my arm wouldn't heal. During the surgery my arm became infected, so most of the bone marrow was destroyed. To this day I have a plate and a bunch of screws that hold it together.

Bob Sheldon: How did you break your arm?

John Shepherd: Playing intramural basketball.

Bob Sheldon: So that kept you out of the Navy?

John Shepherd: Yes, it kept me out of the Navy. Then I took the Federal Service Entrance Exam. This sounds awfully gauche, but I scored well on it. I received a letter from the White House saying I'd been nominated as a presidential intern, appointee, or something. Kennedy was President.

I was in the Pentagon being interviewed, and a lady said to me as I was leaving the office, ''There's a new outfit in Bethesda, Maryland, called the US Army Strategy and Tactics Analysis Group (STAG), and I think you'd fit well there. I'll give them your number.'' I said, ''Fine.'' I'd hardly gotten home when COL Alfred W. DeQuoy called me and said, ''I'd like to see you this evening.'' He sent me to COL Fisher's house in Edsall Park, Virginia, where I was interviewed, and I said, ''Great.'' I didn't know what a model was; he's talking about models, and I thought well, they're females in bathing suits or they're things that have wings and propellers.

That Monday I literally carpooled with COL Fisher and a fellow by the name of Jim Hurd, who was a very talented computer programmer. The first place they sent me was to American University in Washington, DC, to take a course in linear programming.

Bob Sheldon: That was 1962?

John Shepherd: The fall or summer of 1962.

Bob Sheldon: What kind of projects did you work on at STAG? Did you call it STAG at the time?

John Shepherd: They called it STAG. The first job I had was to figure out what FORTRAN's all about. I'd been programming, like everybody else, in machine-level language and STAG had taken delivery of an IBM 7090.

Bob Sheldon: Had you taken any computer classes in college?

John Shepherd: I hadn't had a one.

Bob Sheldon: So you learned about computers at STAG?

John Shepherd: Yes. I got a book from IBM on FORTRAN and I had another book on assembly language. I think I donated them to the Army OR library Van had created at CAA. In any event, IBM gave me a magnetic tape, no hard drives, that had the assembler and a compiler on it. COL Fisher said, ''I want you to figure out what this FORTRAN thing is.'' I worked with it for a few months and realized in going through the machine-level language code in the compiler that I could improve things, and since nobody told me not to, I rewrote it. This got me in trouble. David Taylor Model Basin people would come out to STAG and use our computer occasionally, and they noted that our 7090 was three times faster than theirs, so they called IBM. IBM went to the David Taylor complex and said, ''There's nothing wrong with your computer,'' and then they came to STAG and they said, ''There's nothing wrong with your computer.'' Then David Taylor people said, ''Watch this,'' and they ran their programs on our computer and had the same programs run on their computer. IBM said, ''Somebody's modified the loader and the compiler.'' They went to Jim Hurd who was my supervisor at STAG, who said, ''I think I know who that might have been,'' so I got called on the carpet and told you're not supposed to take products we buy from IBM and modify them.

The other part of the story is John Backus, who I didn't know at the time. He was a famous person out in California and the developer of FORTRAN. John called one day and said, ''I want to come out and talk to you.'' I showed him what I did to the compiler, the loader, and everything else.

The Army signed a letter of agreement, and I had to sign it too, that IBM could market the compiler we had at STAG. Backus told me the following story: I was showing him some code

that was in the compiler that was really bad, and I didn't realize who he was or I would have never said this to him. I said, "You guys really weren't thinking." When you're 22 years old, you make such statements. He said he and another guy had come up with this idea for this compiler and they had presented it to a vice president of IBM, who thought this is a great idea! And Backus said, "On Monday morning I came to work and I had 34 people assigned to me. I had no experience in managing 34 people, so God knows what went into the compiler." Anyhow, that was my first job at STAG.

I also wrote software to drive the war rooms. STAG had these huge screens, and COL DeQuoy was one of those thinkers. He would go to the Pentagon and convince them to give him millions. We had a red war room, a blue war room, and a control room, each with big cathode ray tubes (CRTs) which captured on film the tactical location of all military units. Then projectors in the war rooms instantly developed and projected the tactical units' locations onto these huge screens that were 30 feet square. The Controller's war room had a balcony for the VIPs (very important persons). I wrote most of the software to drive all of that.

NASA (National Aeronautics and Space Administration) was curious about the software to drive the screens. They asked me to write some software in 1962 or 1963 that simulated a moon rover that had a multisecond delay from the time you push the button to have it stop or go, or go left or go right; we were using our terminals at STAG to simulate the moon rover running over terrain using a lightpen to guide it's direction and speed.

Bob Sheldon: Where was STAG located? Was it at the same place as CAA (at that time called the Concepts Analysis Agency) in Bethesda?

John Shepherd: Yes, but there was only the one building there. When I went to work there, the parking lot was just a gravel lot, and you parked anywhere you wanted. There was no charge for parking. The Beltway had not opened yet, but we used it at risk of getting a ticket; and because some of it was still dirt, you didn't drive it when it rained. The Cabin John Bridge was in. Prior to that we drove through Arlington on Wilson Boulevard, and across Key Bridge and out Foxhall Road by Embassy Row, and picked up Wisconsin Avenue; and that's how you got to work. There wasn't as much traffic in 1962, not nearly as much.

Bill Dunn: Why did they choose that location in the first place? I always was curious how it got established in Bethesda.

John Shepherd: I was told COL DeQuoy, who was then a staff officer with the Deputy Chief of Staff for Operations (DCSOPS), started STAG, and he lived in Bethesda. The Rugby Building may have been built for STAG on a long-term General Services Administration (GSA) lease.

Bob Sheldon: In 1963, what other projects did you work on, after you impressed them with your computer skills?

John Shepherd: I didn't stay long. It became abundantly apparent to me after about two years that there was a lot more money to be made. My wife had graduated from college and we had found out we were going to be parents. I went in as a GS-7, got a 9 in six months, got an 11 in six months, and then COL DeQuoy went downtown to try to get a 12 for me. Well, they wouldn't give it to him. I think an 11 paid $8,900 or something like that a year. My wife started teaching school that year and she was making $9,900 a year on a 9-month contract. I kept saying to myself, "There's something wrong here." The Planning Research Corporation (PRC) had a spy someplace in STAG who said, "Why don't you have dinner with us one night at the Golden Parrot?" which was a nice restaurant on Connecticut Avenue. I think they offered me $12,000 or $13,000, and I said, "Great."

My first job with PRC was doing code encryptions/decryptions for the Navy in a windowless building in Washington, DC. My computer ran off batteries; it was in a room that was electronically sealed against the rest of the world, and I had carts filled with batteries. If the batteries in one cart got low, I rolled it down the hall and got another cart. I had three other carts connected in series. I had a young, armed Marine follow me around everywhere. He never smiled; I always worried about that guy. Anyhow, that was my first job at PRC. I worked night and day. I'd go home and help Mary Ina (my wife) bathe our baby and put him to bed, and then I'd have dinner and I'd drive back over in town and work—you did that in those days.

Bob Sheldon: What kinds of programs did you write?

John Shepherd: A lot of the software came from the National Security Agency (NSA), and then we were developing some. I probably can't go any further. I had a debriefing that lasted an entire afternoon and said, ''By order of the President, you'll be shot if you ever tell anybody about this.'' But they (NSA) would bring tapes down—this is before disks—and this car would come with these people that had guns. They would bring the tapes upstairs, and I would sign for them.

Bob Sheldon: How many years did you work for PRC?

John Shepherd: Two or three years. It was a good company. The Research Analysis Corporation (RAC) had moved from Bethesda to McLean, Virginia. A friend of mine was working for The MITRE Corporation, also in McLean, and he convinced me I should go to work for MITRE. Another friend worked at RAC and set up an interview at RAC. Both MITRE and RAC were good interviews. Both wanted to know more about the inner workings of how to program a CRT. I had good feelings about both, but RAC's new building and setup impressed me and they asked ''When can you start work? I'm going to offer you the following.'' I said, ''Wow, okay.'' So I went to work for RAC, and it was a good choice. It was like a university.

Bob Sheldon: That would have been in the late 1960s?

John Shepherd: It was 1965, 1966, somewhere in there. Wilbur Payne was there, Dick Lester; Lewis Leake, a lot of the people you've already talked to.

Bill Dunn: Did you know Lewis Leake?

John Shepherd: Yes.

Bob Sheldon: You guys co-authored a paper, didn't you?

John Shepherd: They wrote it—Dr. Tiede and Lew Leake. My name was on the paper because I wrote the software. But they wrote the paper that won the MORS Prize; I've forgotten what year it was. It was on the Advice II model. It was a computer-assisted wargame, and it had these big CRTs with light pens and everything, and I wrote all the software. It was on a Control Data 1700, a little computer.

Yes, Lew was a joy to work with. Also there were Dr. Tiede, General Whipple, COL Fornoy, and COL Seibert. The joke was that RAC stood for the ''Retired Army Command.'' *[Laughs]*

It was really great. They had a theater group that was like the thespians. On weekends, a lot of times they'd have first run movies in the auditorium, which were free. It was a real nonprofit company. I'd take my son there—he was probably three or four years old. The Army would bring in helicopters and all the kids could look at them and sit in the seats. We had a windsock and a little control tower down at the end of the parking lot.

The best job I ever had. I worked with Tony Fiacco and Garth McCormick. They were writing a book on nonlinear programming and they wanted somebody to write the software. I got tapped to go with these two guys, and they were lots of fun to work with. I remember when Tony Fiacco got married. I think he'd gone to Italy and met this really gorgeous lady, and I went to Tony's for dinner one night with a bunch of other people.

RAC was where we built the Concepts Evaluation Model (CEM), although we originally called it TCM—Theater Combat Model.

Bob Sheldon: Talk about the genesis of CEM. You were on the ground floor.

John Shepherd: Yes. At RAC you could take off and do rotational assignments, and I'd taken a one-year rotational assignment to work with Marion Bryson at ISA; Phil Schneider, who had come from Duke with Marion Bryson; COL Hazeltine; and COL Bob Lum (Bob had a PhD in OR). Seymour Goldberg and Rex Brew were also there. We were programming DYNTACS (Dynamic Tactical Simulator), which was a model being developed by Gordon Clark and Sam Parry at Ohio State. I always brag I put Sam Parry through graduate school.

Bill Dunn: What was ISA?

John Shepherd: The Institute for Systems Analysis. It was a very small outfit, probably didn't have more than 50 people in an old building on post at Fort Belvoir.

Bob Sheldon: Where was that building physically located?

John Shepherd: I was told it was the World War II Women's Army Corps (WAC) barracks

on Fort Belvoir. It was not far from the post theater and the main Corps of Engineers building. They have a big parade ground in front of that old main Corps of Engineers building—same road where you go to the Officer's Club. We were back about a block in the woods.

It had clotheslines out back. It had a very antiquated phone system. Being a ham operator, you study these things and one summer I had a job in the building (I can't tell you where), that controlled all the phones for the East Coast, or at least at that time. They were all mechanically switched then. So I learned a lot about how the phone system worked.

The phone guy was there one day working on ISA's phones and he had the big door open on the cabinet and I'm standing there looking at it and I said, ''Oh, this is a such-and-such.'' He said, ''How do you know about that?'' I said, ''I worked over in such-and-such for Mr. So-and-So.'' ''Yes.'' Well, ISA had it so that Marion Bryson and then Colonel Hazeltine and others had phones that if they picked up the receiver, they would get an outside line. But the rest of us had to wait until it was free to get a dial tone. They could preempt our phone calls just by picking up the receiver, and if there were no other outside lines, it dropped you. I realized in looking at the switching network that if I dialed two or three digits, I always got priority on the phone.

Phil Schneider one day was trying to reach his wife and he couldn't get an outside line and I said, ''I will get you one.'' So I grabbed my phone and dialed these three digits and I got a dial tone and I said, ''Here.'' Then he said, ''How do you do that?'' I said, ''You really don't want to know.'' So it turned out Marion Bryson was on the phone when he got preempted by Phil Schneider. Marion came down and wanted to know how to do it—and I said, ''It turns out there are three digits. Don't you dare ever tell anybody what are the three digits.''

Working for Marion Bryson was just super. They all were. DYNTACS was a lot of fun. It was during the campus unrest, so when colonels would go with me to Ohio State—this was where we were programming DYNTACS—I would ask them not to put on their uniform. Things were kind of touchy. One of them insisted on wearing his uniform, and we had a little thing on the elevator in the building on campus one day. I got off on one floor and said, ''That's it,'' walked up to Gordon Clark's office on the next floor and I said, ''I don't know whether the campus police are going to be here or not, but we've had a little incident on the elevator between COL So-and-So and a couple of students.'' Just the wrong time to be in a uniform on campus.

I left that job and went back to RAC. Jack Newman had called and said, ''We're building this model called TCM (Theater Combat Model), and Joe Bruner wants you back here to work on it.'' I said, ''Great,'' so I told Marion Bryson, ''I'm no longer a Seagull; I'm going to go back to being a nonprofit guy.'' I went back and started writing code. Bruner and Phil Louer were just great, you can't say enough about their capabilities. All I did was write code, but really Bruner was the guiding light and Phil Louer was the man who kept us all steering in the right direction. You need somebody like Phil; programmers tend to wander off. Phil was just incredible. I loved working for him, working with him.

As I recall, TCM was sponsored by the Office of the Assistant Vice Chief of Staff of the Army, LTG Bill DePuy, and was to be a replacement for the RAC ATLAS (A Tactical, Logistical, and Air Simulation) Theater Model. I think it was adopted by CAA in 1973 to perform the CONAF Study (Conceptual Design of the Army in the Field). CEM originally stood for CONAF Evaluation Model. Later it was changed to Concepts Evaluation Model. Many years later, while trying to clean out my garage, I found an original FORTRAN code listing of the ATLAS model and gave it to Van for CAA's OR museum. Over the years TCM/CEM went through three different name changes—they (Phil Louer and Dr. Bruner) even had a contest for the name.

The model grew. In CEM's early days Phil Louer would ask me a question, and I could always rattle off the answer. It's amazing the amount of code that you can store in your brain, and somebody comes up and asks a question and you just rattle it off. As CEM became more complicated and everybody had become intimately familiar with the model, their questions were getting more finite in their detail. I remember not being able to answer a couple of questions one day and having to look at the code to answer the question. Phil said something to

Dr. Bruner about he didn't know if I had the flu or what, but that was the third time that day I had to go look at the code. Bruner came in and asked me if all was well. I said, ''Yes, we're up to 20,000 lines of code, and I just don't recall.'' I said, ''Secondly, Phil asked very detailed questions, and you really have to go look at the line of code to see which way it's going.'' The funny part of this story is sometime later Wilbur Payne called me. I think by then he'd gone over to the Pentagon. He asked me something and then he said, ''What's all this crap about you having a limitation of 20,000 lines of code?'' I thought what on earth is he talking about? Then I remembered, so I think Bruner had mentioned it to him. *[Laughs]*

Bob Sheldon: What year did you start working on the conversion from TCM to CEM?

John Shepherd: TCM was 1967 or 1968. I had taken a year at ISA, so let's make it the start of 1967. In 1973, they changed the name to CEM. Then in the middle 1970s, CAA changed the letters in CEM to be something slightly different. In the meantime, I'd been going to CAA almost on a daily basis making coding changes for the Heavy-Light study. Those of you who aren't old enough to remember, when Carter was President, he (President Carter) went to the Office of Management and Budget (OMB). Mr. Kretschmann at OMB had decided with a bunch of analysts that if you buy a swath of land from the Baltics to the Alps five kilometers deep and you put all these TOW (tube-launched, optically-tracked, wire-guided) missiles in it and you back it up with a ton of helicopters, aircraft, and fortifications that no matter where the Warsaw Pact attacks, you'll be able to fend them off. As a static indicator, it looked good; but CEM said, ''No.'' CEM let the Soviets probe in three areas, and wherever they broke through, then CEM would reinforce this and throw the reserves in. This is where CEM really began to grow. Later, Mr. Kretschmann came to a meeting with the Army and after the Army briefing on CEM results Mr. Kretschmann said, ''We got it wrong.'' This meant OMB had the wrong solution.

Bob Sheldon: Since you were there writing the first lines of code for CEM, how rapidly did that grow? You said it went up to 20,000 lines of code.

John Shepherd: First of all, there were several people who preceded me with the early TCM code. My job, upon returning to RAC, was to get the code working and apply it to a notional test study. Once we got it running, it was applied to a study and it grew fairly rapidly. As you know with models, once you get a certain portion of a model built, it begins to dictate what you can do to it. It's either that or go back and make massive changes to code previously written, which can really get to be complicated. So at 20,000 lines, CEM really was telling you, ''All your improvements have to fit what's already here to some extent. You can't really do a lot that's different.'' I made one major change which took me several months, and that was to go from firepower scores to ATCAL (Attrition Calibration) for attrition computations.

Bill Dunn: That was a pretty big improvement.

John Shepherd: It was a very big improvement. Van and Phil Louer should be given credit for that. From where I stood, Phil was the driving force for this calibration, and he got with Alan Johnsrud, who was a physicist we had at CAA. Alan started working on it, and then Phil came to me. I'd just finished some other project or was about to, and he said, ''I want you to go work with Dr. Johnsrud and see if we can get this thing going.''

I wrote the ATCAL code as a standalone model, and I used CARMONETTE (it is the first two syllables of the words Monte and Carlo, reversed with an ''ette'' added to represent small. It was the first representation of a small unit engagement using Monte Carlo techniques to generate the interplay), one of the very high resolution models that we had, to calibrate it. In other words, I'd get killer-victim scoreboards from CARMONETTE for four or five variations in the quantity of weapons on each side, and then I would feed the killer-victim scores from one of the CARMONETTE variations into what was called Phase 1 of ATCAL—to calibrate the differential equations; and then Phase 2, given different variations in the weapon mix, would compute the hits and the kills; and then I would compare the ATCAL results with the same run of weapon mixes run with the CARMONETTE model.

Mike Garrambone: I went to CAA once to get some weapon effectiveness data to run a model

that I was using out in the desert. My question is what motivated the change in schema? The second part of that is where did you get the data to run the new pieces? I mean, as you're putting code in there, you're thinking, I need this to make it happen. So first, what motivated the change, and second, where were you thinking you might get the data?

John Shepherd: I think the motivation came from Phil Louer and/or Van, I don't think either of them liked firepower scores, and that's all we had. Firepower scores could not account for kills and losses to specific systems and ATCAL was developed to overcome this limitation. I suspect knowing Phil and Van, they both had probably been thinking for some time about how to improve the validity of our attrition computations. When Phil explained the process to me, he said, ''What we're going to do is try to drive it based on killer-victim scoreboards; in other words, we're going to have this real battle that the Army's going to actually simulate, or we're going to take historical data, or we're going to take a high-resolution model, and we're going to generate killer-victim scores. From that, we would like to calibrate the attrition based on one battle and extrapolate to many different weapon mixes in different battles.''

Everybody who sat there that day—I'm sure Johnsrud and I—probably thought this is impossible. You just don't take a single point of data and extrapolate. But Johnsrud was very good about the way he put the equations together and Phil had some good guidance for Johnsrud. I'd like to tell you it worked the first time, but I know you won't believe it. Why it worked was always a question in my mind because I played with the code and I'd go talk to Johnsrud—he had moved to Mr. Vandiver's office in the Pentagon, and I had to take the Metro every morning to show him the results—these were mainframe days. He would have ideas, and I'd come back to CAA and change the code, and then I'd show him some results the next day and so forth and so on. This went on for weeks with Phil Louer working with me every day. It was Phil who suggested I take the exact weapon mix that CARMONETTE had used to produce the killer-victim scores and then see if ATCAL would exactly produce the number of hits by round type, by weapon type as CARMONETTE. If ATCAL's results exactly matched those of CARMONETTE, then that was my first step in saying, ''Okay, ATCAL may be working.''

Keep in mind, ATCAL was a series of equations that were solved iteratively, where the criteria for a solution was convergence, i.e., the difference between the current iteration solution and the previous iteration solution must be less than some user-defined value.

Mike Garrambone: You were doing this in FORTRAN?

John Shepherd: Yes. The second step was to take a different weapon mix and feed it into ATCAL Phase 2 and say, ''Let's get the killer-victim scoreboards and the rounds fired by shooter-target combinations, and then let's see if CARMONETTE comes out with the same answer as ATCAL.'' They were close—second decimal place difference. I ran these tests on as many mixes as I could; in fact, extreme mixes - where I would multiply the number of red tanks in a battle by a thousand over what I'd used to calibrate the attrition algorithm and then compare that with the same run in CARMONETTE, and they were close.

Johnsrud gave briefings all over the US. The Swedes came over; everybody came over. I remember briefing the Swedes on the code and having to stop because somebody had to make the translation between English and Swedish. It worked, and then Phil Louer said to me, ''Put it in CEM.''

That took me a few months of rewriting everything in CEM. CEM's estimation of the situation was based on force ratio which was based on fire power scores. Needless to say the entire CEM situation estimation and associated logic all had to be redesigned and coded based on ATCAL's results.

Everyone uses ATCAL; the Air Force uses some version of it in their theater model, and I think TACWAR uses it. Over the years it's changed. I'm sure more talented people like John Warren, Gerry Cooper, and others at CAA have probably taken it apart and reworked it. I know that because they came to me many years ago and said, ''Do you have any of your original notes?'' and I had notebook paper with penciled notes—all I'd saved. These notes were copied by everyone. Every time I turned around, somebody was going through my notes.

It was Van and/or Phil Louer's idea. Johnsrud perfected it, and programmers, as usual, made it work. I never thought Phil Louer or Van received the credit they deserved.

Bob Sheldon: How long were you at RAC?

John Shepherd: Fifteen years.

Bob Sheldon: What other projects did you work on at RAC?

John Shepherd: The Advice II model. That took a year or two because they wargamed it and constantly improved it; and it was much better than the manual THEATERSPIEL and TACSPIEL, which RAC was so famous for having huge war rooms with three-dimensional tables that eight or 10 colonels on each side would play.

Dr. Herb Figgi and I—he was an MD—wrote the software to determine the types of tissue damage given certain velocities and mass of bullets. That was interesting because the computer would simulate the angle of entry into the body and different conditions of the tissue in terms of muscularity—this and that. The model would then compute the probable trajectories and collisions with body organs and the energy dispersion. This was really the early days of the M-16. It had a small projectile but an extremely high muzzle velocity, and the energy went up by the square or something with the velocity. Our model simulated the energy transfer to the tissue, and the tissue would break down trying to absorb the energy. So the lethality of the round could occur quite some distance from the actual path of the projectile. You'd find the liver or some other organ, just totally destroyed—the tissue would break down and fall apart as a function of energy absorption.

Bob Sheldon: Did you work on the SPIEL models?

John Shepherd: No. The Advice II was really intended to replace that. That (SPIEL) was labor intensive. There were probably 20 or 30 people in TACSPIEL and THEATERSPIEL in the war rooms. Some of the retired colonels from World War II, they were there, and some of them didn't like the computer. When people like me would show up and watch what they were doing, they felt threatened. I remember one guy saying to me, ''If we leave it to you guys, you'll have to have a book where we have to understand things and do all this, and it has nothing to do with military.'' And I said, ''You're probably right.''

Bob Sheldon: When I interviewed Ed Kerlin a few weeks ago, he talked about the SPIEL models. Did you overlap with Ed at RAC?

John Shepherd: He was there and left to go to the Institute for Defense Analyses (IDA). I did not know Ed until he went to IDA. I'd heard his name, and I met him years later when I was in J8. While working in J8 I had an office at IDA, working on a model that IDA had developed called IDAGAM. IDA was another one of the places where I was surrounded by great talent.

Bill Dunn: It sounds like some of that work might have been keying off of things from the Army Materiel Systems Analysis Activity (AMSAA). Did you work with those guys or get information or data from them?

John Shepherd: I did go there and talk to them, and yes, they did have data. I don't recall exactly who it was I spoke with up there.

Bill Dunn: It could have been Pete Reid.

John Shepherd: Yes, I remember Pete.

Bill Dunn: And there was another modeler up there—Richard Sandmeyer.

John Shepherd: Yes, I remember him. I was trying to think of the guy who headed up AMSAA at the time.

Bill Dunn: Joe Sperrazza's the first one that I think of, but he was probably later.

John Shepherd: He came down. We gave him a briefing, he and Herb Fallin. We had ATCAL running, and he understood it. Herb and Phil Louer got into a debate over something; I remember it was getting a little hostile when Jack Newman or somebody said, ''Why don't we take a ten-minute break?'' You always hate this. You're the briefer, and two people at the conference table—they're the elephants; you're just a blade of grass—and they get into a debate in front of you and you just stand there like well, should I slowly disappear or go away before they take it out on me?

Bob Sheldon: While you were at RAC, it sounds like most of your travel was local in the DC area. Did you have any data gathering missions in Europe or anyplace else for locations you were modeling?

John Shepherd: Not that I was aware of. Phil and Bruner gave me a magnetic tape—this is

all before disk drives—with killer-victim scoreboards on it to put in CEM. I ran it through Phase 1 of ATCAL, and I was coming up with probabilities of hit that were infinity. What had happened was in our high-resolution model, we had killed weapons and never fired a round at them. Glen Stockton headed up the program. I went to Glen and said, ''You guys have really got to go through this model.'' I said, ''Look at all this stuff you're giving me on killer-victim scoreboards.'' He was pretty embarrassed; I guess they'd never looked at all of it. But Phase I of ATCAL read everything in and computed the probability of kill (PK) based on the number of hits divided by the number of rounds fired by round type and shooter-target combination. There was more than one instance where one round had been fired and five weapons had been killed or no rounds had been fired; and of course, the computer dividing by zero gives you infinity, and it gets an overflow, and it caused some hiccups.

Bob Sheldon: Were you mostly modeling the NATO (North Atlantic Treaty Organization) versus Warsaw Pact Fulda Gap scenario?

John Shepherd: Yes, almost 100 percent of it was CEM in those days, and all the data I received was Fulda Gap and the Warsaw Pact versus NATO. The engagement ranges in the south were so close because of the mountainous terrain; you had battles down there, but they were so small compared to the Fulda Gap where you had these huge engagement ranges and much larger forces.

Bill Dunn: I missed the timeframe for that piece that you were just discussing. What era were you looking at?

John Shepherd: This was probably middle-1970s, 1975, 1976. General Research Corporation (GRC) had bought RAC in 1972, and I was still a GRC employee for some period of time on contract to CAA. Phil Louer, who had gone to work for Abe Golub in the Pentagon, called me at home one evening to tell me that GEN Whitehead was going to try to convert me over to a Seagull, they called it. The next morning I received a call from—I think Newman was the Deputy Director. Jack Newman said, ''Can you come and meet with GEN Whitehead?'' I did, and GEN Whitehead put his arm around me and he said, ''We want to convert you to a Seagull.''

He then went on to say, ''Let me explain what a Seagull is in case you missed the finer points. It eats and shits, and it squawks, and it's protected by the federal government. There's a lieutenant colonel here, and he's going to take you down to Buzzard Point and swear you in.'' And I said, ''Shouldn't I resign my other job?'' He said, ''I'll take care of that this morning.''

So I did. I went with the lieutenant colonel to Buzzard Point and raised my right hand and became a Seagull.

Bill Dunn: What was at Buzzard Point?

John Shepherd: The personnel office where you were sworn in.

Bob Sheldon: What year was that?

John Shepherd: Between 1976 and 1978. I don't remember what year it was.

Bill Dunn: You were working in Bethesda at the time?

John Shepherd: Yes, it had converted to CAA from STAG by then. Jack Newman had been my boss at RAC, and Jack left RAC to become the technical director at STAG. Shortly thereafter the name was changed to CAA in 1973 (when CAA took over STAG), and GEN Hallgren was the commanding general. I worked there for a year or two, still under GRC auspices; on contract. The whole thing started when I got a call from Phil Louer—who worked for Abe Golub—and he said, ''Can you come to CAA and help us modify CEM?'' I said, ''Well, I'm in the middle of doing [whatever it was].'' The next thing I know, my boss at RAC said, ''No, you aren't; you're on contract to CAA.'' I went over to the Pentagon, and either GEN Whitehead or Hallgren met me in the hall and said, ''This is what we want you to do.'' Phil came out and talked to me, and the following day I went to CAA in Bethesda. That was, I think, the Heavy-Light study. It had a lot of urgency because President Carter was about to cut the forces in NATO, buy real estate, and put in a ''Maginot Line.''

Bill Dunn: During that era, Europe was the main theater of interest. You never did any theater support to Vietnam?

John Shepherd: No, I never did.

Mike Garrambone: Did you go to Germany and walk the turf?

John Shepherd: No, I was just a programmer, a worker bee. We had people who did that and came back and they wrote wonderful reports.

Bob Sheldon: Do you have any anecdotes about working with Wilbur Payne?

John Shepherd: First of all, I think he was bored with life. In those days, we smoked and he would come into my office in the morning with his coffee and cigarette and we would sit there and talk about CEM or something else. He liked to play jokes on people, and every time he came in I knew he had done something. One of the things that he would do was take the cord out of the base of the telephone, put scotch tape over the contacts on it, and then plug it back in. The phone would ring, but you couldn't hear or say anything into the handset. We'd sit there and he would make a phone call to this person whose phone he had rigged and we could hear them in the hall saying, ''Hello, hello, hello.'' And Wilbur would just die laughing, and we would laugh to the point tears would come down our cheeks. This was just his mind waking up in the morning and coming in and having fun.

Jack Newman called me in one morning and said, ''You are going to get in trouble. I know Wilbur is up to no good and he is in your office and he's getting ready to pull another practical joke on somebody.'' He would take the light table that people would look at for view graphs and he would disconnect the bulbs or connect them so they didn't come on and people would be down there trying to look at their view graphs through the light table and it wouldn't work. We used blackboards with chalk in those days. He would put lacquer, or something, that dried quickly on the chalk. People would be trying to do things on their blackboards and the white chalk wouldn't rub off. Or he would do things to erasers so that they would cloud up the board. It was just Wilbur's way of having fun. I really enjoyed hanging out with him.

When he left RAC, it is rumored that he signed his resignation to Frank Parker (President of RAC) on toilet paper—but I don't know this to be a fact. He asked me to come with him and I told him I just couldn't stand the Pentagon. I thought the offices were horrible and all he wanted me to do was probably go to meetings. I loved writing code and modeling and I just couldn't conceive of going over there.

Bob Sheldon: When you moved from RAC and became a civil servant, did you stay working in the same office, same building?

John Shepherd: Pretty much same office, same building. I had been there about a year or two working for GRC under contract to CAA and then when I became a civil servant for the Army, I literally went back to work the same day. I returned to RAC the following morning to clean out my office and General Schroeder who was my boss (at RAC) was pretty upset with me because he had heard that I was leaving. I got a few things and said goodbye to a few of my friends and that was it.

But same office, same phone number, and I worked with the same people. Bill Allison was a young major then; he was smart, caught on to FORTRAN, and picked up CEM so quickly he intimidated me. Ralph Johnson, our PhD mathematician, did the same thing. Ralph was a hard worker. You would have never known him to have a PhD. He just rolled up his sleeves and wrote code. What impressed me about him was he had no ego problem. He would bring his code in and he would say, ''Go over this for me and let me know if I've got this right.'' He was that sort of worker.

Peggy Louden, a young lady who worked with us on CEM, was very pregnant at the time but was another dedicated, smart, hard worker. Phil Louer was our group chief—he had a way of making us all feel important and appreciated. They were a fantastic group of people to work with. Phil Louer had put together the best team I have ever worked with.

Bob Sheldon: Did you ever take any computer programming courses?

John Shepherd: I probably did. I don't remember.

Bob Sheldon: So you more or less taught yourself about computers?

John Shepherd: The computer languages I seemed to pick up. Gerry Cooper observed this at RAC many years ago. I have forgotten what the language was but it was probably under the Control Data Corporation (CDC) 1700. He said one day to Dr. Tiede, ''I have watched John and he picks up languages very fast.'' Part of that is due to experience. My first language

was assembly language. You understand pretty much how the computer works at that level. Then I moved to FORTRAN. Most languages aren't that different. I say that because I probably wrote C++ but I really wrote FORTRAN in C++. I think your first language tends to have great influence on the new languages you pick up or at least how you apply them.

The last simulation I worked on, the Exploratory Regional Insurgency Simulation (ERIS), was an insurgency-counterinsurgency simulation for CAA. I wrote that in VBA (Visual Basic Applications) which is not the same as Visual Basic. Karsten Engelmann gave me a book on VBA. I talked to John Warren. I said, ''If you use VBA, what are the pitfalls?'' In five minutes, John knew me well enough to explain to me this is how you would normally do it but you can't do it this way in VBA. He went through four or five examples. As I wrote 18,000 lines of code over the next two years for ERIS, those were exactly the pitfalls that I would have fallen into. John Warren knew me that well.

I pick up languages fairly fast but I probably program in that language just as if I were in FORTRAN. There are exceptions: Smalltalk and the Joint Warfare Simulation (JWARS). The precedence is completely different in Smalltalk than all the other languages. Keywords are a number one priority in Smalltalk and you have a list of keywords that Smalltalk can recognize and you can create keywords. But you had to be careful. When you go through Smalltalk code, it isn't what's in the parentheses so much as whether or not there is a keyword there. And then the hierarchy falls into whether it's a multiplication, etc.

When I programmed in Smalltalk, I used a lot of parentheses because I knew the compiler would solve for everything inside the innermost parentheses before it went to the next outer parentheses. I could force that compiler to generate the code the way I wanted it executed. I just enjoy computer languages.

Bob Sheldon: What were some of your other projects at CAA?

John Shepherd: CEM, ATCAL, and then I got into parallel and distributed processing. This was a project that Gerry Cooper had started with Bob Orlov. Bob had left CAA to go to J8. I have forgotten who it was—maybe Mr. Hollis—said you need to take this over. So I flew out to California to the Jet Propulsion Laboratory (JPL) to talk to the people about parallel processing. I had a tremendous teacher out there who is now here in the local area—Fred Wieland who finished his doctorate at George Mason University in OR. Fred was a young guy at JPL at the time. Professor David Jefferson had conceptualized something called the Time Warp Operating System, which allowed simulated events to be executed on separate processors while maintaining synchronized timing among the events.

Bob Sheldon: What year were you studying parallel processing?

John Shepherd: This was in the late 1980s, early 1990s. This was completely different because now we had instead of one processor and everything executing in sequence, we could have 1,000 processors with things executing in parallel and some events of the simulation could get ahead of other events executed on other processors in terms of simulation time. If the simulation detected an event that would influence a previously executed event on another processor, it would roll back the previously executed event and recompute its results. That's about as far as we want to go.

Dr. Jefferson had conceptualized Time Warp. I think Dr. Reynolds at the University of Virginia (UVA) was working with it. Richard Fujimoto worked at JPL and then Richard went down to Georgia Tech and I think is still there. Just a lot of brilliant people. I had the good fortune to work with some of the finest minds in the world.

Bob Sheldon: Did you put this on a Cray supercomputer or some other kind of parallel processor?

John Shepherd: Actually, we had a parallel processor at JPL, the name of which escapes me. It had 32 processors and we had a portion of the simulation running. It was running rather well and the speed up curve where the X-axis is time and the Y-axis is the speed up was just about a 45 degree line up to a point and then it went flat.

It was all done in C++ and we created small objects that talk to each other a great deal. Once we had results to look at we found that

small objects tightly coupled (sending each other a lot of messages) wasn't the way to do it. Rather, the best approach was to have larger objects that didn't talk to each other as often and try to collocate objects that did interact with each other on the same processor—which may not be feasible or cause other timing problems. So we were constantly having to synchronize these processors with these objects talking to one another. I remember briefing Mr. Hollis and saying I just blew a lot of your money last year, and we have to go back and re-code it so that instead of an object being a tank, these objects are now companies and battalions. In those days you smoked. I remember to this day he took his little cigar out of the corner of his mouth and said, ''John, somebody has to be first; go on.'' *[Laughter]* He is on my very short list of heroes.

One night I found, through a mutual friend, that the Air Force had an intelligence center not far from Los Angeles. I had a phone number for an Air Force colonel and I called him and told him who I was and what I wanted to do. I said, ''If I get Mr. Hollis to call you, could we borrow your parallel processor (which had 1,000 processors on it)?'' He called me back about an hour later and he said, ''When can you come over?'' I said, ''At your convenience.'' He said, ''Can you do it in an hour?'' I said, ''I don't know, we will try.'' If we get a ticket, we will get a ticket because we were at JPL's lab in Pasadena and he was on the other side of town.

We drove over and he let us use their parallel processing computer. We knew then, I think we ran it with 500 processors; the speed just kept going at a 45 degree angle. We owe the Air Force for that one; and no charge.

We gave briefings on Time Warp. Lots of people attended. We gave papers at West Point—standing room only. People sat in the aisles. It was the same at the Naval Academy. Fred Wieland and I gave four or five papers at both academies during MORSS.

Bob Sheldon: A specific issue that comes up in parallel processing: there are some problems you can parallelize and divide the problem into pieces and then put them back together again. Other problems, you can't parallelize. How did you tackle those kinds of issues?

John Shepherd: Time Warp took care of some of this. Time Warp took care of any synchronous message passing between objects, and what I'm saying is they were not synchronized. An object moved across a bridge and it then continues to maneuver on processor A. Well, what about processor B, where an aircraft attacks and destroys a bridge sometime before the other object has crossed it, but after processor A had executed the bridge crossing? Time Warp would detect this and it would roll that (event); the tank crossing the bridge (notionally speaking) and now it would say the bridge is gone and the tank is prohibited from crossing the bridge—it would cancel the bridge crossing. Time Warp took care of all of this sort of asynchronous timing of events—but at a cost in terms of running/execution time.

If you were totally oblivious to Time Warp and parallel processing, i.e., you coded it as you would normally code, your simulation would probably run slower than if you knew you were going to have to simulate events that were synchronized. For example, let's put all the tanks and aircraft that are in one portion of the theater on the same processor. I have a submarine that's located in the Gulf running on the same processor that the tanks are on in the western portion of the desert. They are going to have events that don't influence each other. So you had to think a little bit about your scenario, try to assign your objects to the processors in such a way that when you put an object on a processor, most of the object's interactions with other objects occur on that processor. Now, that's within limits; we would break it down into finer granularity. Things that were in the northeast portion of the theater might be on a processor. The northwest portion might be on another processor. We knew they were going to overlap and influence each other but perhaps not as much. Sometimes we would make several runs and adjust which objects were simulated on which processor. Also, one must try to balance the amount of executed instructions on each processor—load balancing. If one of the processors has more instructions (events) to execute than the others, it may lag behind the others in simulation time—the keyword is, ''may.'' The art was not well understood and will vary by scenario.

Bob Sheldon: Were you running a model that copied the algorithms from CEM to put in this parallel processor, or did you create new algorithms for that?

John Shepherd: As I recall we did use ATCAL for attrition computations. The rest of the model was based on new design and code. We could go down to the individual tank.

Bob Sheldon: What was the model called?

John Shepherd: The simulation under development using Time Warp was called CTLS, Concurrent Theater Level Simulation.

Bob Sheldon: Was it used for any major studies?

John Shepherd: No. When Bill Lese was getting ready to put JWARS together, we talked about CTLS and CTLS was just too esoteric in Bill's opinion, and I think he was correct. It was doubtful you could turn it over to a normal OR group and expect them to effectively use it. It was a university thing that people wrote PhD papers, and tried to improve on but it requires some understanding of what you were doing.

Bill Dunn: From CAA, how did you end up working with Bill Lese?

John Shepherd: I gave a paper at MORSS at the Air Force Academy and was in the Academy library doing something and Bill came in and introduced himself. He said, ''I'd like to have you come to work for me.'' I just liked him. He had a nice way about him. I went to the Pentagon and interviewed. They asked good questions. The person who talked to me about linear programming, he was an Air Force colonel, asked good questions. It was the first time somebody other than Gerry Cooper had really gotten down into that level of linear programming. There were others in the room, Vince Roske was there and a couple other colonels. I was impressed with all of them.

I said, ''Let me think about it.'' As you know, Bill can be very persuasive. He called the house and talked to my wife. She said, ''I really like him.'' I said, ''Well, he is just very persuasive.'' So I went to work for him.

I had no idea what a Form 9 was but my first job was to put together a Form 9 so that some world leader would be uninvited from General Vessey's retirement ceremony. I said, ''You're kidding. I don't do that. You don't want to know the derivative of X to the N or N times X to the N minus 1 or something like that?'' He said, ''No.''

I lived on the phone. Bill made me Secretary to the Defense Science Council group (consisting of senior scientists from the four services, with Mr. Hollis as the Army rep and Bill Lese as its chair). This meant I had to get all of these important people to one place at one time, which was incredibly difficult. I must have smoked a pack of cigarettes a day. My day began at 6:30 in the morning when Bill came in. One night I couldn't get home. The Metro had stopped running at 11:00 p.m. and I didn't know that, so I had to take a cab home.

I told Bill the next day, two things are wrong. One, the finance people owe me for about 15 trips. My wife said there are few people who can afford your job because I think at that time they owed me like $18,000. And I have got to have a place to park. I can't stay in here until 11:00 p.m. or 12:00 a.m. and find a way home. Typical Bill, he called somebody by the name of Kay and said, ''I want him put on Senior Executive Service (SES) travel status and I want an SES parking place for him.''

The first thing that happened was I tried to park in the assigned parking slot and an Air Force colonel was already there and I said, ''I think this is my parking place.'' On the days I didn't use it I would call the Air Force colonel and say, ''I'm going to be out of town for the next five days.'' The colonel would come by my office and I would give him a little thing to stick in the slots in order to get up to the river entrance. He was pretty good about it.

But that was working for Bill. I lost 15 pounds. I lived out of a suitcase.

Bob Sheldon: What other kinds of projects did you work on?

John Shepherd: It was everything. It was issues. General Mahaffey served as Commander in Chief of US Readiness Command (REDCOM). He wanted to do certain things so he sent a back channel message to General Vessey. I guess the Chairman, Joint Chiefs of Staff (JCS) didn't really want to do what General Mahaffey wanted so I got the job to go down and talk to General Mahaffey in Florida and tell him, ''This isn't going to really work.'' Why they didn't tell him themselves, I don't know.

So, I flew down to Tampa and Mahaffey wasn't there. I turned the rental car in and went back to Washington. Admiral Carter, Director of the Joint Staff, said you need to go back down there. Mahaffey is there and wants to see you. So I went back to National Airport and went back to Tampa and the lady at the car rental place said, "Didn't you just turn this car in?" I said, "Yes ma'am." I drove back out to the base and the guard looked at me like, "Didn't you just leave?"

That was my life. I just walked around with my briefcase and my suitcase and I used the BOQ (Bachelor Officers Quarters) laundry to get my laundry done. I would call my wife and I would say, "I'm at Fort Lewis, Washington and I will see you when I see you." You have been there—you know the feeling. But if you worked in staff positions, you really didn't write any code. You just did what they told you to do which was to simply go do this, go talk to this person, attend this meeting …

Bob Sheldon: How long did you stay there?

John Shepherd: I was there 18 months. Bill had gone to CENTCOM in Tampa, and Mary Ina didn't want to go even though they had a nice CIA position for her. She wanted to stay here. I had drifted off into JSOA, the Joint Special Operations Agency, doing a few things and figured this probably isn't me. I called Mr. Vandiver or Phil Louer and said, "I'm going to look around." One of them said, "Can you be here Monday?" and I said, "Yes." By then we had another general that headed up J8—Joe Rigby. I just told him, "I'm leaving."

I left and went back to CAA the following Monday and reported in. J8 was good experience but staff jobs will kill you.

Bob Sheldon: What year did you go back to CAA?

John Shepherd: Whenever Bill left to go to Tampa—around 1986. I remember I had talked to Van and Phil that morning about returning to CAA and within 20 minutes, the phone rang and it was Bill Lese from Tampa saying, "What's wrong?" I thought, "Do you have microphones on everyone's desk?"

Bob Sheldon: CAA was still in Bethesda when you went back?

John Shepherd: Yes.

Bob Sheldon: What tasks did you go back to at CAA?

John Shepherd: It may have been working with the parallel processing which really would have probably put it in 1989 or 1990. Shortly after I returned to CAA, Bob Orlov left and went to J8. I'm not sure but Bob may have taken the position I had in J8. He or Pete Byrne, they both left about the same time from CAA to go to J8. J8 was a real experience. What day is it and what airport am I in?

Bob Sheldon: Any new model developments in CAA that you worked on?

John Shepherd: The parallel processing—and then I got with the Institute of Land Warfare people at Intelligence and Security Command (INSCOM) who were working on the Theater Exploitation Study System (TESS) at Skyline Towers in Falls Church, Virginia. They had spent a lot of money on it and Mr. Hollis had asked Pete Reid to head up a panel to take a look at it. They had hardwired some code so you really couldn't change the tactics and do things. After the Reid panel completed their investigation, Mr. Hollis decided to merge TESS with CTLS to form the Advanced Regional Exploratory System (ARES).

We then decided to have PRC help us merge the simulations. I think that was done in C++. I was not popular because any time you take a model apart, there are a lot of people that have a lot of effort in that code and it's easy to go in and find faults. But I presented a case to PRC where they recognized that we needed to simulate tactics as well as weapons; we just couldn't say to the model, "Do this and do that." I had a way of doing it and they agreed.

I worked with Berlin Lewis, who was an INSCOM analyst. Scott Bergman was the head civilian employee. A lot of trips to the West Coast to PRC's office; coming back here, getting that code to run on a computer here that wasn't a Control Data 6600 which they had developed TESS for. PCs (personal computers) were coming into existence by then, so we needed to have it running on a PC which meant some significant code changes.

Bob Sheldon: Were you still doing the Fulda Gap scenario?

John Shepherd: No. It was Desert Storm, because I gave a paper at the Naval Academy and I had invented this scenario. I had never attended a briefing on Desert Storm just to make

sure we weren't contaminated. I got called on the carpet after the briefing that it was identical to the Hail Mary that was going to take place but had not taken place yet. Some of the view graphs were actually taken from me by an Army major. Dr. Griff Callahan came to my rescue. He said, ''I know this guy, he wouldn't do that. He would be very cautious.'' I thought for a moment I was in serious trouble. Callahan was a retired colonel that worked at Georgia Tech. Nice guy. He just happened to overhear the conversation and immediately vouched for me.

Bob Sheldon: Was this a MORS symposium you were at?

John Shepherd: Yes. It had to do at that point in time with a little mixture of parallel processing and just a standard sequential processing. The unfortunate thing is there were a few people there who really understood parallel processing and they were asking a lot of questions. I think 90 percent of the audience was like, ''What in the hell are they talking about?'' I realized then, don't mix these briefings. Don't bring in parallel processing and asynchronous message passing and all these things that make you sound smart. Throw that in the trashcan and let's just talk about the model and talk about the scenario and the results.

All of a sudden INSCOM and Mr. Hollis decided that they would go with JWARS. Bill Lese had been a good politician and I was tapped to go over and be the technical director under Jim Metzger. That was fine. I had an office in the Pentagon and broke my right wrist while building a deck on the back of my house. I was running around in my cast and trying to learn to use a mouse with my left arm which had 10 screws and a plate trying to hold it together.

Metzger and I had worked together before at CAA. When I got over there, I think I was tainted in my attitude a little bit toward him. Things didn't get any better. After a couple of months I just told Bill Lese, ''No thank you.'' I went to talk to Mr. Hollis; Hollis said, ''Will you do this for me?'' That's hard to turn down because he is one of my heroes. I went back for another month and I finally just said, ''No.'' I hated to disappoint him.

I went back to CAA. About two years later we moved from Bethesda to Fort Belvoir. Colonel Andy Loerch came to me and said, ''We are having some meetings over in Rosslyn, Virginia, on JWARS and we would like to have you attend to have you technically separate whatever is going on from whatever is really going on.'' Wally Chandler was my boss and I said to Wally, ''I don't want to go over there.'' Wally said, ''Just go to a couple of meetings.''

This evolved over the next couple of months. The meeting frequency increased from one or two days a week to five days a week. Mr. Hollis said, ''I really need you to work at the JWARS office in Rosslyn. You don't have to put up with anything. You are the Army representative. If somebody says something to you that you don't like, tell them you represent me.'' I said, ''Okay'' and Van asked if I would go. I said, ''Yes, I will try it.'' And I went. Jim was very cooperative and so was everyone else. There were a lot of contractors. I was the Army guy. Commander Boots Barnes was from the Navy. The Air Force was represented by Lt Col Greg McIntyre, a really smart guy. He had a PhD. And the Marine Corps sent a guy, Steve Stephens, who was sharp. The contractors were really good. I had never used Smalltalk, just learned it and worked in the vault in Rosslyn and was in the vaults when 9/11 occurred. I went out of the vault and looked out the window and the Pentagon was on fire. By then there were 400,000 or 500,000 lines of code in JWARS. I focused on the land portion, a little bit on air because they were kind of mixed. I stayed there five years.

Then I got a call one morning and Van said, ''All is forgiven. Why don't you come home?'' I said, ''I think I'm just going to retire. Some of our investments had paid off extremely well.'' We had bought land in Fairfax when in the 1960s you could afford to buy a little bit, and we still had it. The kids were out of school. Van said, ''No, I want you to come back.'' Then Mr. Hollis called and said, ''I want you to think about insurgency and what could we do in counterinsurgency.'' That was how I spent the next four or five years. So I ended 50 years of programming on a very high note: writing code, doing something I loved, and building a model. It ran. I was very proud of it. It's where entities talk to one another and influence one another's attitude toward the government and

the insurgent, as may be influenced by barriers, religions, politics, and ethnicities.

Bob Sheldon: What language was that written in?

John Shepherd: That was in VBA because it comes with Microsoft Office. If you have Excel, you have VBA. It's a very easy language to use. There were a few things that none of the books talked about that I wanted to do. For example, I wanted to pause the model and then go into the input data and make changes or draw graphs from the output and see how events and entity attitudes were changing. It turned out the operating system wouldn't let me do that. As soon as I would pause the model and drag it off to the side of the screen and click into the Excel spreadsheet, Excel would abort. Everyone I talked to said, ''No, you can't do that. You are jumping between two levels of the operating system and Excel will not let you do that.''

There are discussion groups on the Internet. Some are good, some are bad. I put out an e-mail and said, ''This is what I'm trying to do. Does anyone have any suggestions?'' I got tons of e-mails back. I even got one from Microsoft saying, ''We're going to bring this up at the next standards committee.'' But I received one e-mail from a person in Crystal City who said, ''I think I know how to do this.'' It turned out he worked with a bunch of guys that I had worked with on JWARS and he said, ''Everybody over here knows you so if you will come over here and buy coffee one morning, I will try to find out how to do this.'' I said, ''You got a deal.''

I went over one morning, grabbed a half dozen doughnuts and went upstairs and got into a room and sure enough, everybody in there was the old JWARS crowd which they then called the Joint Analysis System (JAS). This one person was hacking away at his computer terminal, four or five of us were standing around talking when this person smacks his hands together and claps and says, ''That's it.'' Four or five of us ran over to his terminal and looked over his shoulder. There is a switch you could set to ''ignore'' which allows you to jump back and forth and in and out of your Excel spreadsheet while you were executing your model. I went back to CAA and set the switch - and I could pause the model, go in and change things, draw graphs, change data, and then restart the model. From that point you could run ERIS for a day or two, a week, or six months, then pause it, review the output, make changes to the input, restart the model at that point in simulation time and repeat the process as often as you liked.

I worked on things like how to make screens go away. You would have a screen full of something and you would say, ''I want to do this now so I need a different screen.'' Well, how do you get the current screen to go away? I couldn't find anyone, even on the Internet, who knew how to do that. So I said to myself, ''The screen is an object, and it's got a page and behaviors, and behaviors have attributes.'' So I broke it down into an object-oriented type fashion. There were two attributes that I had seen which hinted at this. One was visibility—could be true or false—and the other was active or inactive.

After about an hour of hacking away at it, I got the screen to go away and another one to come up. I don't know that this is supported by Microsoft, but I sent them an email and I said, ''You really need to document how to do this.'' I never got a response back. But it works. So part of programming is to figure out things the books don't tell you.

Bob Sheldon: One of the challenges in our business is for people who understand the phenomenology of warfare to communicate with computer programmers who write programs to simulate it, so you get good verification and validation of the simulation. What are your thoughts on that?

John Shepherd: I agree and I have had many embarrassing moments. Julian Ewell, a retired lieutenant general, explained to me how counter-battery fire worked, converting direct support (DS) artillery to general support (GS) and using it to suppress the other side's DS and/or GS artillery.

He explained it quite well on the blackboard, and I thought I understood it so I wrote all the code. I ran it that night and much to my surprise both sides had converted all of their artillery to GS, and all the artillery were shooting at each other's artillery and there was no DS artillery. It was all counter-battery fire. So I thought well, I didn't understand General

Ewell's explanation very well. I had Phil Louer and General Ewell come in and say, ''This is what you did wrong.'' Are there limits? And what is the logic an artillery or a brigade commander or division commander uses to determine how much artillery is suppressed opposing direct fire and indirect fire weapons? They explained to me, it depended on how much direct fire was occurring, how many losses you were getting, how much close air support you had, in order to determine how much you would suppress.

Bob Sheldon: Give us some of the high points of your career.

John Shepherd: Another high point in my career, I worked at MITRE on a rotational assignment for a year. I worked for a retired General Bill Tidwell. I liked him.

Bob Sheldon: What was his function?

John Shepherd: During the Vietnam War, he had been head of overhead systems or something like that. When I worked for him he was a division chief at MITRE.

Bob Sheldon: Is that while you were working for RAC that you were on rotation?

John Shepherd: Yes, you could take these rotations and while at MITRE, I shared an office with Dr. Max Oldham. Max had been head of ORD (the Office of Research and Development) for the CIA and had retired. We were doing optimal locations of ground sensors and Max had all the theory and I had to solve all the equations and program the computer to notionally, incrementally, move these sensors to different places to get the maximum coverage for different terrains and different theaters. It was a nice job. I liked it. I liked working for Max. In fact, Phil Louer called one day to ask me something and I said, ''I am working with your old boss.'' It turned out that Max had been Phil's boss so they talked on the phone a while. It is a small world, really.

I was there about a year. Nothing of any great consequence. I didn't care for MITRE that much. Management was very straight-laced, very structured. Tidwell was a nice guy; I liked him. I think he was putting in a vineyard down on the Northern neck or something at that time which I had thought about doing. I had subscribed to some viticulture newspapers and magazines. He and I talked a bit about that.

I left there and went back to RAC or GRC, whatever it was called at that time. RAC was the kind of place where they encouraged you to go off to school for a year or two, go to another company if you wanted, or go to the government. I was at ISA when Newman called and said we are going to build TCM and we've got to get you back here. They had started it and people had failed. I guess somebody had said that you have got to get Shepherd. He's dumb enough to do anything.

Bob Sheldon: It used to be that the services had their own civil servants and officers who wrote computer code. Nowadays, almost all of the code is written by contractors, and the services have people to provide oversight. What is your opinion about that?

John Shepherd: I agree. First of all, private industry tends to pick up people who are very current in their education on programming languages and on computers.

Second, you really do have to invest in your government people in order to make sure that what the contractor is selling you is what in fact you wanted and are paying for. A classic example was JWARS. When I started to go through the code, I put in what are called breakpoints that allowed me to watch the code execute, particularly for the land warfare. Very early on I found that a subscript in an array was not being incremented, and I went across the street to another office and the programmer over there was a very nice guy. I said, ''I'm either reading this wrong or here is what's happening.'' I showed him the printout. He said, ''Oh my God.'' He went through the code and he said, ''You are right.'' In my opinion, somebody from the government has to go down and do those sorts of really trigger-pulling type exercises. I found the AH-64 was engaging targets at 5 km, and I could not find in the data structure where to change that. Their Hellfire will do it but the chain gun isn't going to reach out 5 km and annihilate targets.

I went through the code and it turned out that there is only one parameter in JWARS for the engagement range of the AH−64, and that is for all weapons on the AH−64. So I went to the programmer and I said, ''We can't live with this. If we live with this, we will just buy chain

guns. We will stick three or four in an AH-64 and take over the battlefield.''

I think over time, I had about two pages of things I thought were really wrong. And things that sneak up and bite you that really aren't the programmer's fault. If I changed the random number seed, I could find places where aircraft were engaged by a surface-to-air system. But if I changed the seed, in the next run they weren't. It depended on the sequence of events that occurred. For a discrete event model, I don't think this should occur. Just too much can change because if you shoot down the aircraft, the aircraft then don't do their missions and then you say, ''This will average out statistically.'' Well, maybe it does, maybe it doesn't.

But then that event changes the next seed for a subsequent event; whether or not the submarine in the straits was detected. And then it's detected in another run and it gets torpedoed or it is sunk and it's all because the sequence of random number seeds. My theory was, I wrote a short paper, events in some portion of the battlefield ought to have their own random number generator. Submarines in the straits that are located 500 miles away shouldn't be dependent upon an event that occurs in the western portion of the theater for aircraft being engaged by air defense systems. And this is the government and contractor's responsibility. It's not sloppy programming; it's just something somebody didn't detect.

Bob Sheldon: Any other topics that I should have asked you about?

John Shepherd: There was a study I worked on, I think it was sometime in the late 1960s. We had the riots in all the cities and somehow I got asked to participate with this federal task force to take a look at them and see what we could do for the police department. RAC had quite a bit of Army money that they could channel into different things that had to do with public safety. A fellow by the name of Dick Longmire at RAC had written a proposal and we had gotten this money.

Dick and I flew to various cities where they had riots and tried to come away with some assessment as to what the government could do to help. One of the things was of course regional communications—police and fire departments with regional communication capability. We also noted that the fires in Newark had only the Newark Fire Department which was just simply not up to responding to many different places in the city simultaneously.

We found one fire department who had come in from a surrounding town and who in our opinion had fought a key fire and had subdued it. We interviewed the Fire Chief of that volunteer fire department and asked, ''Why did you go there? Did anybody tell you to go there?'' And he said, ''No, we were just driving down the street, and we saw the fire so we turned down there and fought it.''

Bob Sheldon: What year was that?

John Shepherd: That was late 1960s. We got to Chicago and we were assured that Chicago had a very secure communication system with unknown frequencies on certain walkie-talkies and we were shown the intelligence center where the secret frequencies were being monitored. Suddenly we heard music coming in over one of the secure radios. It turned out in questioning the chief that someone had stolen a walkie-talkie out of one of the cruisers and they didn't know what they had but they were playing music over it.

There were things like this that surfaced. We needed encryption for certain things and digital was just coming along. Beam antennas, I was a ham operator, so I could talk to them about the RF signal envelope that antennas produce and how to direct it and try to keep it from radiating 360 degrees or even 180 degrees.

That grew into an algorithm to take the data from the cities and rank the relative importance of each of those cities and different places in terms of the payoff to the terrorists who might want to bomb and do things to them vs. the risk of being caught or failure. If the terrorist fails, the government PR (public relations) is good. It shows the government is doing its job and the terrorist is not. If on the other hand the terrorist succeeds, the public becomes alarmed, particularly if there is collateral damage of civilians.

Bill Dunn: Did that get put into practice?

John Shepherd: Yes it did. Fairfax County was one of the first I worked with then. Chief Durr and Captain or Lt Columbus (I actually remember their names) and Major or Captain Dottson who was head of intelligence then. We started putting in a whole new system of radios, a very

expensive system with repeaters around the county. There are dead spots for communications. It's just one of the geophysical phenomena in communications when you rely on FM particularly. Towers were put up or we rented space on tops of buildings.

In these repeaters, the early days before cell phones, we would pick up the signal and retransmit it and this is how a cruiser with maybe 15 watts of RF (radio frequency) power out could talk to somebody in Woodbridge from Centreville.

We also told them they had to secure these systems. One of my jobs was to determine the vulnerability of targets in Washington and I actually had a letter on me that said if I am arrested, you are to call this number. I purchased maps from various federal agencies showing the location of all communication towers and public water systems and you name it. We gave a briefing to the Provost Marshal of the Army about this, and I remember he was ill at the very thought of the study results ever being made public and he classified everything. So Fairfax was the first. I think we then went into Arlington and Alexandria and put everybody on the same metro frequencies, and then Maryland began to pick up.

We found problems. For example, let's say there was a problem in Baltimore. The governor of Maryland at that time was a different political party than the mayor of Baltimore and if one declared a state of emergency and called out the National Guard, this was an admission that political parties had failed. There was some disconnect as to who was in charge and who was going to declare what. This was not just Baltimore, it was other cities. Somebody had to set up a hierarchy and make these decisions to be responsible. The riots produced some good government changes.

Another thing. I applied the use of linear programming (LP) to determine, based on the aircraft and the type of target, the optimal mix of fins, fuzes, and ordinance on board aircraft carriers. This linear program was put on board ships and it automatically ordered things that it would predict shortages of. It automatically looked at different targets and sorties that you are planning down the road. It looked at the inventory and did all this stuff. That was interesting.

Bob Sheldon: Was that for the Navy?

John Shepherd: Yes, that was for the Navy.

Other than having to get my budget approved for my parallel processing and whatnot, times were good. You (Bill Dunn) and Gene Visco and everybody else down there, I think I submitted monthly reports and purposely wrote them so that nobody would understand them. *[Laughter]*

Bill Dunn: We actually read them.

John Shepherd: I didn't think there were more than a dozen people on the East Coast or West Coast who understood what we were doing. Mr. Hollis would ask good questions; he impressed me more than once with real insight into things.

Bill Dunn: We kept expecting this massively parallel technology was going to provide a big breakthrough, but it never did quite get to full-scale production.

John Shepherd: I think what happened was the advent of the PC. The speed at which the PC evolved over a very short period of time, probably two or three years, just simply made parallel processing inappropriate for simulations. It was esoteric. You had to understand it. If you wrote straight code and didn't keep an eye on the fact that you had to have things (objects) that were going to talk to each other a great deal, that interact with each other, located on the same processor, it didn't run much faster than on a single processor. When you compared the speed with the PC as it evolved, for $500 or $600, I have a computer at home that just simply today outruns anything I grew up with. STAG paid $7 million for that IBM 7090 in 1961 and my home PC is 1 million times faster and more capable.

I think Mr. Hollis had the right idea. It's just that the technology overtook the idea because up to that point in time, we were getting one run a day on CEM and the other models and we couldn't live with that.

If I were to summarize, I'd say I had the best job in the world, working for and with the best people on the planet.