Computer Oral History Collection, 1969-1973, 1977

Interviewee: Jackson Granholm
Interviewer: Robina Mapstone
Date: June 7, 1973
Repository: Archives Center, National Museum of American History

MAPSTONE:

Today is June 7th 1973, and this is Bobbi Mapstone and I'm talking with Jackson Granholm and I guess we are in Thousand Oaks. Is that where we are? Thousand Oaks, California. And this is an interview for the Smithsonian Computer Oral History Project. We are now recording. Let's go back to just what we were talking about, and mention about where you graduated from and what your degree was in and how you got into working for Boeing.

GRANHOLM:

Okay. I graduated from the University of Washington, which is in Seattle, in physics and went to work for Boeing in the Industrial Engineering Department. That's typical of the kind of request searching that one finds in the personnel people of a large corporation. And so I complained enough about working in Industrial Engineering so that I was transferred into the physics laboratory. At that time the physics laboratory was part of what was called the Physical Research Staff. The primary jobs that we did had to do with testing and design of testing ranges and testing instrumentation for an early day set of guided missiles now defunct, no longer built. One of the -- there was a number of pressing problems that required a lot of human [labor] in missiles. There was the question of computing a trajectory from the tracking data, of computing the in were all gathered ..[in a form] that was retrievable only by human beings. You know, people read the records. And the records were voluminous. So it was necessary from things like angles and ranges to compute the three-dimensional trajectory of the missile and find out where it went. So some kind of mechanized attack on this seemed sensible. Through a long series of attempts and trial and error, we discovered that it was possible to educate an IBM tabulating machine to compute trajectories if you gave it trigonometric tables so it could look up trig functions. So that we did. And I think that was probably the first thing, the first work done at Boeing that could be called a computer application in engineering. It was dreadfully slow. It took all night on the tabulator to compute trajectory for about fifteen seconds of missile flight. At about that same time IBM had some rudimentary electro-mechanical and electronic calculators that we convinced the company to buy those. By definition, all of the tabulating equipment belonged to the accounting department because they were the ones that used it. So what we had to do was do some in-house convincing of the tabulating department that they ought to buy the equipment so that engineering could use it. These machines, while they were electronic, were not like calculators or computers they had access to a bundle of functions and they**…**machines and…built the machine logic and one or more control boards

first companies to order an IBM1 701, previously the Defense Calculator. That was the first stored program computer with logic wired in. The company had it. Shortly after that, we also acquired a 650, a drum computer, much smaller machine. During this period of time we**…**department and set it up in engineering. I became the first operations manager of the engineering computing lab, it was done. And then there was one in the whole company. There were many computing laboratories in the whole company now. After working for approximately two years as the operations manager of the computing lab, I got tired of being in a job in which, in essence, I always worked on other people's problems. It has some of the aspects of running a laundry for other people's [dirty] clothes, so I asked for a transfer to work that was more inventive, you know, more development oriented. Nothing happened, primarily, I suppose, because in the job I was in. So I solved that question finally by resigning and working for the General America Corporation on a study of computers in the insurance business. I did that for a year. At the end of the year, the question was pretty much resolved in the insurance company. It wasn't really that complex a question to start with. The answer was really: if it's a calculation, yes, you can do it on a computer; and if you organize it properly you can do it more efficiently than you can with rooms full of ladies pushing desk calculator buttons. So I then returned to Boeing in a quite different part of the company, an experimental flight test. There was a problem which could be computer-related and they made it computer-related, and that was how to gather all the information from a series of airplane flight tests, and reduce it to a form fit for human consumption in some reasonable amount of time. Now, I can illustrate the magnitude of the problem best by pointing out that in the instance of the Stratocruiser, which was the next previous air-plane to the 707 that Boeing had certified commercially, there was a period of six weeks following the final test flight during which the Federal Government examiners, the FAA, did nothing but wait for the information to be ready for them. It took that long. It was that much lag time, six weeks from the information gathered on the flight…until it could be put in engineering terms so they could decide on it. So it was all done by people. By taking advantage of [what] technology there was, tape recording that would go in an airplane, multi-flexing equipment that we had stolen from that used on missiles and slowed down to a rate more amenable to what happens on an airplane, and set up ground equipment which enabled us to edit the flights, to select portions of them and rate digital tapes using them. We were able to prepare any and all flight data so that we could process it with a computer. The computer we used to do that happened to be a particularly good choice. It was a UNIVAC 1103A, and whether the world has progressed or not I don't know, but that machine was well-suited because it was a large high-speed machine. Other manufacturers also had those, but it had non-synchronous tape logic. By that I mean that there was no particular timing or order required for rating information on the magnetic tapes that that machine could read. It used a sprocket track and it read the next row of information when it came along. So we had no need to buffer flight information. We wrote it in digital form, after digitizing it, in a free-running stream of how the tape was ...[plotted]. The computer didn't care. So that was a great design simplification. The same machine could also read tape either forward or backward, and I think unless you order special equipment. You can't read data that isn't properly plotted and you can't read it backwards. The reading backward was useful because the records from the airplane

were often messy and spotty and had drop-outs. They were done on analog tape. So some of the information was garbage. We didn't particularly care, but it was nice to have the computer throw out the garbage rather than have people edited it out. So we would attempt to read the digital tape a number of times, in fact, twenty times forward and twenty times backward. And if we didn't have a successful read after that many trials, the computer then proceeded to the next block and made a note to it that what it had just seen was not readable. Based on the need to process a lot of flight-test data- and by a lot, I mean approximately seventeen computer hours seven days a week for a period of a year -- we also structured soft-ware that really got all the attributes of the present-day master control program. We educated the computer every time we went on it for the complete data run, and it, in essence, issued instructions to the operator on how to change tapes, what to save, what to plot, what to list, and then set itself for the night and called for the information that it needed, and wrote reports on its progress as ...[it went] and allotted facilities to some extent, too, in the sense that we were a little bit bound to the number of tape machines that we could use. I went from that job sort of by management edict on to a number of other jobs at Boeing, none of which I found very fascinating, but having to do with preparing proposals for new business and preliminary design of other the first all-electronic testing system that ever flew [on] an airplane. There are many like that now, but that one actually worked. The pay-off was also well worth the expense, I'm sure, in that the final test data on the certification flights of the 707 was complete and in the hands of the Federal examiners at noon of the day ...[following] the last test flight. It was all done when the flights were coming in. Having discovered that I didn't want to hang around the Boeing Company doing those kinds of things much longer, I left@ and went to work for TRW as sort of a technical guru, and went around telling people how the world ought to be and rating briefings and things for the Federal Government. I did that for about fourteen months, and then spent three years as an independent management consultant. A year as the president of a small company making technical films, two years as a vice-president of Informatics, which was a software company, two more years as a vice-president of Wolfe Research and Development, which was another software company, a year as a research scientist with Teledine, Teledine Systems Company, and during that year I was in charge of Abiotics shuttle vehicle on a contract to North American Rockwell Information Division- or Space Division, I guess as it was called then. A space shuttle.

MAPSTONE:

Space shuttle. Not the space lab that they've got up there now.

GRANHOLM:

The recoverable vehicle, which isn't built yet. It should now be in phase two or phase three of the design. It should be at the point where they're starting to build prototype hardware. And I spent some more time doing management consulting, primarily for the General Electric Company and for the U.S. Navy. I did a good deal of work for Data Nation Magazine from time to time, and began working for the Brown Realty Company and then the Janz Realty Company two days a week, financial forecasts and evaluations,

and kept doing that with enough interest...[and] success so that I could sort of graduate, got to the point where I could come in every day, which is nice, since it's a two minute drive to work from home. Tell you all my personal history. That's about it. All right.

MAPSTONE:

---------I'd like to get a date. When did you join Boeing the first time? 1947 is the first time I was there, after I got out of the university. I worked there before that, when I was a student, as a machinist. But that doesn't really count.

MAPSTONE:

No, it doesn't. Okay. As operating manager of the computer lab, you must have run into all kinds of brand-new problems. What were some of these problems?

GRANHOLM:

Well, there were many problems in structural design, which used up about half of the available computer time we had. Like on site one. That was quite interesting. The computation of buckling bolts [modes?] for columns of non-uniform cross section. The buckling modes are well-known for columns of constant cylindrical cross-section, squared cross section, but they aren't well known for tapered columns or stopped columns or the other kind of funny things that the Greeks and Egyptians used, you know, believe it or not. It was a complex solution. So that was a modeling and program job that took quite a time. There were some 10 problems, interesting problems, of optics, retracing through nose cones and other oddball shapes. Problems in design and test sections for supersonic air tunnels, which were on the stake. Those were the big interesting kinds of problems that I recall.

MAPSTONE:

And these were the things that you were working out using c.p.c. type devices?

GRANHOLM:

Primarily. Or the 701. We took many problems over unto that machine and restructured them somewhat.

MAPSTONE:

What about the people problem of getting a computing lab set up, the training, the teaching of programming? Was**…**we train our own people actually. We hired people. tried to hire them with a math degree and some interest in applied math, or sometimes engineering or chemistry or physics or any kind of academic background in which they might have been exposed to relatively higher level mathematics, and computing to get an answer if there was some sticky wicket problem So we trained them on the job. It

was sometime hard to pick the right people out of the great crew of folks that apply for work at an aircraft company. You know we made mistakes sometimes. We'd pick those manifestly poorly suited, and usually they removed themselves after they had made the discovery of the grisly facts. Sometimes you had to either suggest they transfer to different work or work in a different company. That's hard to do in a big aircraft company. You know, it's almost sinful to terminate an engineer, or it was then in the early days.

MAPSTONE:

The Big Daddy symbol.

GRANHOLM:

Yes. Right. You hoard engineers in little nooks because you might need them sometime. Engineer by definition is anyone who's in the engineering department. That's all the technical people, not necessarily an engineer by education, but one by definition.

MAPSTONE:

And in the late Forties, then, Boeing was into missiles and planes. Were those their final functions?

GRANHOLM:

Oh, yes. Boeing's always was in airplanes. It's their chief business. In fact, ... in addition to being pretty we managed for an aerospace company, their chief claim to fame, I think, is performance stretching. They build things that are bigger and fly higher and faster than any**…**ments in aircraft that were astounding from the standpoint of stretching the state of the arc. I don't think people call Boeing a company that's done much basic research, but they've done great performance development. They built the first all-metal passenger airplane in the world. They built the first pressure cabin airplane in the world so it could fly to any altitude without being on oxygen. They've repeatedly built the largest of any kind of airplane in the world. They now build the largest jet bomber than we know that anybody builds, and certainly the largest jet transport, the 747, which is, as a matter of fact, if you look at it, is a larger airplane than the C5-A, which is the thing the military has. It's…

MAPSTONE:

Is it military?

GRANHOLM:

Um-hm. It has the all-time standing current world record for payload in flight. That's one of the ways you determine how large is a transport airplane? Because it's gotten off

the ground and flown successfully with more load than any other transport, jet or prop.

MAPSTONE:

Having ... The first time I was in a 747, I really felt I needed to help it take off

GRANHOLM:

Yeah, I flew in one empty. I was on vacation in Seattle and some of my friends in flight test asked me if I wanted to go for a ride. The airplane had nothing in it and there were suites. It was like riding in six dancehalls (laughter) Okay. In Seattle you were really out of the mainstream of the West Coast computer, aerospace computer, and gang.

GRANHOLM:

We thought so, yes.

MAPSTONE:

Was this a problem? Were you in communication with the other aerospace companies?

GRANHOLM:

Well, I think so. In fact, there were a number of people who used to come by regularly in order to see whether we had any ideas they hadn't stolen yet particularly the people from North American. They appoint a visiting as often as possible. And it's understandable that that would be so, because there were a number of those years in which Boeing was the largest defense**…**And they have been, from the standpoint of dollar volume, for many years the largest aircraft manufacturer. They were so large in 1933 that the government split up the company with an anti-trust suit. They still remained very large.

MAPSTONE:

What was the split? Boeing and . . . ?

GRANHOLM:

Boeing, United Aircrafts, United Airlines, Pratt Whitney, were all Boeing companies. They were all part of Boeing.

MAPSTONE:

Well, good. Very good. And United Aircraft is entirely separate now.

GRANHOLM:

Separate company, right. But it was part of the Boeing Company at one time.

MAPSTONE:

So you had people coming up and were you sharing ideas? Was this done?

GRANHOLM:

Oh, yeah, sure. We went to many technical conferences, here and the East Coast. You know, I don't know that we were particularly secretive about what we were doing.

MAPSTONE:

Were you in these mainstreams of the computing idea, like when Share got set up and part of that?

GRANHOLM:

I would say that I probably couldn't recall, because I wasn't with the Boeing computing lab by that late date.

MAPSTONE:

This was '54 and you were somewhere else by then?

GRANHOLM:

Right. I was in flight testing.

MAPSTONE:

So you first knew people like Frank Wagner and John Strawley, then? Oh, yes. Right.

MAPSTONE:

You mentioned the wind tunnel work. Did you tie in at all with the Carpenter wind tunnel project? Or was that too far away from you? There had been a Carpenter wind tunnel project done.

GRANHOLM:

No, we weren't in it, and for very valid reasons. Boeing is one of the few aircraft companies that own three of its own wind tunnels. Most aircraft companies don't have a wind tunnel. It also has, by far, the largest flight test organization in. The world, larger even than the largest military flight test group. Boeing has more people that work in flight test than Edwards Air Force Base has. It's one of their strengths in performance

testing, and traditionally has been.

MAPSTONE:

So they had a tremendous need then for…

GRANHOLM:

Aerodynamics and flight tests have always gotten ample funding and tremendous support in the Boeing Company. That's why they own three of their own wind tunnels, and lease essentially the bulk of the time on a number of other wind tunnels, like the University of Washington tunnel, supported by Boeing.

MAPSTONE:

So this really would have been one of the great reasons for needing data reduction, I guess is the term.

GRANHOLM:

Um-hmm. Right.

MAPSTONE:

Okay. I had an idea that just went out of my mind. Oh! Yeah. Were you in contact with places like Rand and UCLA and the computing that was going on down there?

GRANHOLM:

Only distant.

MAPSTONE:

Did Boeing get into building their own computing devices?

GRANHOLM:

Oh, yes. Boeing not only built them but sold them.

MAPSTONE:

Oh?

GRANHOLM:

W@ built the B-Mac, which was an electro-mechanical analog computer, very large one.

We did that for simulation of missile systems. We built the B-Ac, which was an electronic analog computer sold them on the market for some period of time, then sold the entire operation, the design, the patents, and inventory, to another company. I've forgotten which electronic company bought that project.

MAPSTONE:

B-Mac and B-Ac.

GRANHOLM:

Right.

MAPSTONE:

Do you know some of the people, can you name some of the people involved in it?

GRANHOLM:

Well, the chief designer of the B-Mac was George Stoner, who's now dead. He was a vice-president of Boeing until his death about two years ago. Moved up from an engineering manager. There's a man--his name I can't summon up--what probably still at Boeing that did most of the clever design work. I would think that if you want to find a man at the Boeing Company who might know, you should try G. Hollingsworth, who probably is the head of the research lab unless he's changed jobs. G-u-i-l Hollingsworth.

MAPSTONE:

At Boeing in Seattle.

GRANHOLM:

Right.

MAPSTONE:

Do you recall approximately the dates of these two devices?

GRANHOLM:

Well, the B-Mac would have been 1950 or earlier, and the B-Ac a year or so after that. Boeing also has built; they built one of the largest digital simulating facilities of some huge digital computer which they probably still have. And I don't know who built it or why it was put together, it was long after I left. And if you want the man who knows about that, I would suggest George Roc, R-o-e, who is still around the Boeing Company, though maybe he's not there. He lives on Vachon Island out in Puget Sound, so you can

find him at home. He's . . .

MAPSTONE:

V-a-s-h-on?

GRANHOLM:

Yes. I know his home phone number, if you want it.

MAPSTONE:

Yeah.

GRANHOLM:

I'll see if I can dig it out. R-o-e, Route 2, Box 574, Vashon, Washington, 98070. Phone is area code (206)**…**And this was a digital-type simulating device, ultimately a large sort of that kind? No, it wasn't a DDA. It was a large machine on which you could model computers.

MAPSTONE:

Can you tell me something about the B-Mac and the B-Ac, the type of machine, the technology used, what it was used for?

GRANHOLM:

Not really. You'd do better to talk to someone who under-stood analog computers. Right.

MAPSTONE:

And they were sold commercially?

GRANHOLM:

Well, the B-Ac was. The B-Mac was one-of-a-kind.

MAPSTONE:

Okay. Were there - -

GRANHOLM:

Walter Frantz was the man who designed the B-Ac. He is probably still there.

F-r-a-n-t-z.

MAPSTONE:

Walter . . . B-Ac, right, was Walter Frantz?

MAPSTONE:

Were there any other computing devices that came out of Boeing?

GRANHOLM:

No. There was a language, the ...[Bacaic] language.

MAPSTONE:

...[Bacaic?]

GRANHOLM:

B-a-c-a-i-c. It was Boeing algebraic interpretative coding, or some such thing. It was a Fortran-like language, but it was implemented differently. It was interpretative rather than compiled, and it was designed to run on a 701 and possibly updated later for other computers. We began working at it in 1950. In fact, I had a crew that started working on it before the computer was delivered,, as I recall. That language never went anywhere else in the world, except that it was also implemented on somebody's machine. The RPG-2000? One of the Librascope computers. That's the one. The RPG-30 used Bacaic language. The reason that it used Bacaic language I guess is that there was a man who became an applications engineer for Librascope, who worked at Boeing for a while. I don't remember his name, but I did hire him. Oh, Clay Boswell. That was the guy. If you want to know more about computing at Boeing through that interpreter, you ought to talk to Randall Porter, if you can find him, because he was - - he came from, oh, where? I was thinking Lockheed, but he didn't come directly from Lockheed to Boeing. He was the chief of engineering and computing until he left, which was after I left there. So all that period of time he would know all the people and what happened.

MAPSTONE:

But you have no idea where he is now?

GRANHOLM:

The last I heard of him, he was in Orange County. Well, I got a phone number here somewhere. I don't know if he is still there or not. The death rate of little companies

I have area code 714-645-2747. This is the only number I have from him. (pause). Yes, that's all.

MAPSTONE:

And he did work on the Bacaic language. Is that right?

GRANHOLM:

Oh yes. And the chief architect of that language ended up, I think, being Mandalay Grimms. I don't know where she is, I think at IBM or somewhere in the depth of Poughkeepsie or one of those crazy places back East.

MAPSTONE:

So she is no longer with us again.

GRANHOLM:

I don't know. She surfaces once in a while. I haven't**…**Bacaic was really Boeing's contribution to the many 701 languages. Was there any reason why you didn't go with the IBM's B Code, I believe it was called, wasn't it?

GRANHOLM:

Oh, I don't know why. Really didn't pay that much attention to it. You see, I'm sure that I became and probably remained suspect by many computer people because I tried 20-in software or only in hardware. I worked in both of them, and I was very interested in both, and in fact, the four years I put in flight test had a great deal of concern with hardware design and building and check-out, but they also had to do with software design and heck-out. So I had approximately thirty programmers working in the software system, and about an equivalent number of electrical engineers working in the hardware system. And the two went together.

MAPSTONE:

That was pretty unusual.

GRANHOLM:

Um-hmm.

MAPSTONE:

One of the things that becomes most apparent, or is apparent, is that the hardware people and the software people didn't talk.

GRANHOLM:

No, they don't speak to each-other.

MAPSTONE:

That's right.

GRANHOLM:

Each one thinks the other one, the other group, is nuts. That accounts for many of the idiocies you find in the world. And, of course, that also gives you someone else to blame so maybe it isn't all frivolous.

MAPSTONE:

But you were at this point working hard to not have this happen. You'd already seen it as a…

GRANHOLM:

No, not particularly. I was just trying to do a particular job, which was to put together a system which could fly on other related jobs that it wasn't exclusively that, it was the development of hardware which could close the communications gap between testing an airplane in flight and cranking the answer out in the computer. And that's rather a complex path, since we didn't have a radio link with that kind of data capacity. So we captured 2050 instrument readings every second in flight, and flights were m any hours long, and that's a hell of a lot of data. Only a computer can look at it sensitively.

MAPSTONE:

How did you do it? What kinds of machines did you use to get, and software? Were these DDA's?

GRANHOLM:

1103A. Logical concept and in a good deal of its hardware is still at the Boeing -Company and is still testing airplanes. The chief change has been in the computer hardware. There are now, last time I looked, there were two IBM 360-70's, I believe, which would have made it a double-headed monster gone up with the rest of the system, as they say. At least it was some two years ago, last time I took a tour of the thing. No particular need to change it. And everyone knows how to do it.

MAPSTONE:

You've been some kind of a, to use your own word, guru of the computing business, and I was just curious. When did you start to get this over-all view of the industry?

GRANHOLM:

Gee, I don't know.

MAPSTONE:

When were you conscious of looking at it as a whole? Or did it just happen and one day you sat down and you wrote a paper, and you suddenly realized, My God, I've been looking…I don't know that I know of that either. I was asked to write a lot of papers on the Boeing system, and I did, and some were published. And in the papers I wrote I injected philosophy, I guess, or belief on how computers ought to be designed, why they were not designed that way, and pointed out that the people in the world that designed instruments act as though they had never heard of a computer, and vice versa, and that there was a tremendous amount of the world's important work that required that instruments be fact, the technology of process control is based on anon lying control and real time systems and all those other neat buzz words. I know that the design world still pays.

GRANHOLM:

Enough attention to that important factor. I would say that some of it apparently does. The Teledine Company, for instance, builds an entire set of instrumentation that's specifically designed to be controlled and sampled by digital computers. In fact, you ought to look at that. They're doing an excellent job, unheralded and I think not even recognized in the computer process, selling on board computers and data systems to the commercial airlines. You know. And they're putting them in all the 707's and all the big jets. And I would guess the day when aircraft maintenance is done by arbitrary schedule is going to disappear completely. It will be done when computer records says something needs to be fixed. They tear an engine out if it doesn't need to be retrofitted or repaired? And the guy that you should talk to about it is . . . Oh boy, can I summon up his name? Hugh . . . Something. Well, at any rate - -

MAPSTONE:

It'll come.

GRANHOLM:

Yeah. The place you go is the Teledine plant, which is just east of the L.A. Airport, and it's on Aviation Boulevard. In fact . . . Okay. And I can't remember the guy's name who is the chief pusher of those little computers and systems. But go talk to John Graham, who is strangely enough no relation, but a good friend and he's the chief of manufacturing for the plant. He'd lead you to all the people you'd need to talk to. There's

a significant development that has never appeared in Data Nation. plus the computer people in the world. I don't know it exists, and that's, well, one of those areas neglected by those who are software experts, as virtually the whole damn field of process control has been neglected. There is nothing like a language or a compiler or a monitor program that I know of in process control. Every time anyone builds a cement plant and process controls, they start over again. They've reinvented the world at least hundred and fifty times by now, probably will continue to do it.

MAPSTONE:

Why do you think that's happened?

GRANHOLM:

That's just the way it is.

MAPSTONE:

The nature of the days.

GRANHOLM:

Well, there are some weird beliefs in the world. You discover that take the people who build the computers that ride on board space vehicles, okay? You can list those people readily. It's a pretty short list. There's IF there's Teledine, there's AC Spark Plug believe it or not, Hamilton Standard Corporation, the propeller makers. Those are the people who build computers to ride space vehicles because these things are, first of all crammed in a cigar box, they're super-miniaturized, and they're super rugged because you have to be able to throw them of a hundred-story building and hit the concrete and still work. This is the kind of…they maintain in the boost into space. These people firmly believe that the application of the…serve is so unique that all of the great development in software for computing laboratories at UCLA or anybody else who just sits on the ground and computes is not applicable, and neither is the internal computer logarithm. That's ridiculous. Of course it's applicable. Then go fly it. But no one has. The whole thing, the typical space computer is a short-word has a set of instructions different from any one else to the point where, you know, I have people going out saying that the government should pay money, so we develop a whole new set of languages that a re useful only on space vehicles. And that won't probably happen, because, you know, the story which I consider to be highly false but repented many times and is even bought by folks in places like NASA and all who know this, though they don't know why the believe it. Well, that isn't answering your question of how did I develop an over-all view of the computers. Well, I didn't realize that I had. At the same time that I was asked to do articles on the …system I was also pretty interested in writing and I was going to night classes at the university and submitting things to magazines which had nothing to do with computing, but, you know, just to find out whether in fact I could write something that was publishable. I had very bad luck because the first thing I ever submitted was published

in American Mercury and they paid me a fat royalty for it and that's a poor way to start. But I began to discover that it was quite easy to write about things that were basically silly in the computing world, because there were so many damn things that were silly. And if you just wrote about it factually, everyone realized they were silly and they would all laugh. But…wouldn't do anything about it except laugh, but those kinds of things became very popular, the question anyone's solved yet, or, you know, the way you design computers to make them as impossible as you can for a normal person to use. I remember one of the all-time great projects I got into by mistake had to do with a military computer that resided on a submarine and the specifications through many pages, pointed out that the computer must be shockproof and totally watertight. In fact, the machine was tested with the case closed and run on a schick table and run in a shower-bath simultaneously to make certain no water would get inside of, you know, the submarine site. It had to be totally watertight in case there was a . . . In order to start the computer and get it on the air you had to open the front door on it, which violated the whole thing and made it all ridiculous.

MAPSTONE:

(laughter) That's great!

GRANHOLM:

It's true.

MAPSTONE:

You--Wait a minute. Let's turn over the tape before we go any further. We might as well get another one out.

[End of Tape 1, Side 1]

[Start Tape 1, Side 2]

MAPSTONE:

Okay. All right, you were talking about some of these articles you wrote on flight-testing system at Boeing. Do you have any of these around or can you refer me to them?

GRANHOLM:

Yeah, I've got them around but, you know, I don't have them with me. I have great big scrapbooks of them on a shelf in my library. Buried in paper and I don know where they may be. I don't know. I'm not sure I can dig them out. So what I would really suggest is, give me, you know, a week to dig through scrapbooks and find the materials that I think you'd be interested in, and come back and call up and come by.

MAPSTONE:

Ckay. That would be good.

GRANHOLM:

They're probably in libraries.

MAPSTONE:

Yeah.

GRANHOLM:

In fact, you know, the Library of Congress surely has all of them, because they were published not in obscure things but in trade journals,

MAPSTONE:

The Library of Congress is bound to have them. The problem is that, you know who wants to trot over to the library if you say you can find them and just get them copied, and into our data banks.

GRANHOLM:

You can't retrieve them readily there? They don't have a service that will pull them?

MAPSTONE:

It's pretty difficult. It takes so long.

GRANHOLM:

Well, see, most of those things, even the obscure technical or trade publications are indexed somewhere and all. I mean, you aren't going to find the Mechanic's Journal in the Reader's Guide to Periodical Literature, but you find it in some similar list of trade and technical publications.

MAPSTONE:

Yeah, that's true. However, one of our ideas is to gather as much of it as is possible in one place, so that if people are coming to use this as…help in some . . .

GRANHOLM:

Do you think they are?

MAPSTONE:

If they come and use it as a research place they won't have to bend, you know, they'll have some stuff available for a start. At some point or other you, I believe, took over Fred Gruneberger's newspaper.

GRANHOLM:

That's right. That's true. Yeah, Fred was moving from General Electric-Stanford to the Rand Corporation, and didn't want to take it with him. I took it over by mistake, really. I tried to convince**…**sold, but I did it.

MAPSTONE:

How long did you run it?

GRANHOLM:

Five years.

MAPSTONE:

And it was what? Computing. . . I've forgotten the name.

GRANHOLM:

Computing Is.

MAPSTONE:

Right.

MAPSTONE:

Computing Is. Yeah. And so now when you took it over was that when you became a sort of legitimate magazine from a newsletter, or had it already become that?

GRANHOLM:

I don't know what makes it legitimate. I applied for a second class mailing permit and got it. So I guess that makes it . . .

MAPSTONE:

Oh, that's pretty legitimate

GRANHOLM:

Yeah. And I, as I say, I did it for five years, and when I got to the state of where I was residing in Thousand Oaks and working in Tucson, Arizona, and I really didn't need a part-time publishing company, so I made arrangements to sell it to Ian Dunn, who published it for some time with Bob Forest and Bill Rolfe working on it. And they had some kind of management falling-out in which they tried to in-house idiocy or something. It sort of like a Data Nation type of magazine?

GRANHOLM:

No, I think that the guys in, I forget, Chicago State College described it most aptly. He said," It's the world's only esoteric trade publication." So it was kind of a newsletter for in people, I guess. That's the way you describe it.

MAPSTONE:

Was it a sounding board for you and your other people working with you to sort of express what you felt about the industry as well as just _ _ _ _ _ _ _ ?

GRANHOLM:

Oh, I'm sure it was, yes. No question of it. I used to do devilish things with it. Take a five page IBM press release and edit it for content and end up publishing two lines.

MAPSTONE:

They must have really liked you. (laughter)

GRANHOLM:

There weren't that many complaints. Some people seemed to like some things quite a bit. We received all kinds of commendations from the Burroughs Corporation for the write-up on the announcement on the B-5000 computer. I had kind of a friendly feeling about that, I guess. They flew me to New York at their expense for Mr. Eppert's speech in the Waldorf-Astoria, and gave me more free booze than I really cared to drink, but presented their case rather well the first time and then I think they forgot what they said. But I described the B5000 rather accurately and apparently was one of the few people there who did, because you know the typical reporter from the Hoboken Journal wouldn't have known what they were talking about.

MAPSTONE:

So then it was just a giant br…

GRANHOLM:

Yeah.

MAPSTONE:

What do you think were some of the really significant highlights in the whole computing field? And I think, you know, this would be hardware, software, people, and ideas.

GRANHOLM:

Well, the first significant highlight it seems to me was John Parker and his ability to get government research and development contracts and money to finance to get those two things.

MAPSTONE:

This is the John Parker of ERA?

GRANHOLM:

Yes. He was really the pioneer of computers in the commercial world. He was before anyone else. He was primarily a manager and financier. I don't think John Parker would know a computer if he fell over it in the bathroom, but he knew it was a saleable product and proved it. Second great episode and I think it really was second in time, was Eckert and Mauchly, based on their work at the Morse School, getting a contract to build the UNIVAC from the Bureau of Census. The contract in retrospect was ridiculous. They couldn't possibly perform under it. But they didn't know that and neither did the Bureau of the Census at the time, so it was over. I guess the third great episode would be the decision, which was probably made by accident at Remington "Rand, to buy the Eckert and Mauchly corporate, because that meant that the UNIVAC contract was viable. It now had a pipeline into a large pot of capital, and considerable freedom to do something, because I would guess there was total lack of top management understanding what was going on. The next one surely would be the IBM decision to compete in that marketplace, as I understand. I don't know whose idea, inside idea. Well, that was the first decision that we could hand on T. J. Watson, Jr., you know, and obviously the right one. Later they were so great in marketing ability that, you know, even had the machine been no good--which was not true; it was a very good design--they'd have made the right decision. I don't know if there are any significant milestones beyond that, except that those events sort of led to everybody turning into a computing business. I guess the next big shake-up was that a whole bunch of them now forgotten about. They sold out, and collapsed. You know, J.B. Rea, CDC, C whatever it was that sold out to National…

MAPSTONE:

CRC.

Yeah, on all of the little companies that came and had great ideas and not really enough capital or enough understanding of market place to survive--or thought they couldn't--and went down the tubes. There was a rash of those who followed one another pretty closely. Alwac the hell remembers where J.B. Rea is? Whatever happened to all the people that worked at Astro-Data and Redd Program? Where did all the

So really what happened: first you had the machines and the excitement, then a lot of companies without marketing know-how--and that seems to be what happened to say Alwac and J.B. Rea and CRC and so on--and ' then you get to the next level, which is know-how, computer know-how. Yes. I guess at all you can say. Well, the marketing how-how has always been important. Not only the marketing know-how but the marketing strength, and that's where IBM still has it over all of it's competition, because for every, quote, "expert," that the competition can put in the customer's office, I can put five of those experts, able, by sheer weight of numbers, to cover the marketplace. They have all these funded marketing very well. You want for naught if you're in a marketing job at IBM.

MAPSTONE:

Whereas for instance Rem-Rand and UNIVAC, should have had a tremendous edge in the market, lost it for some reason.

GRANHOLM:

Well, the company was . . . indecisiveness of top-level management apparently tremendous amount of internal fratricide, you know. We've got to kill Joe because he made us to make two sales last month and that makes everyone else look bad. It went on for years and still does. And very poor training of people in many instances. You get the guy with the book and say, "That direction's west. Go there." It can stack that up against the kind of a program IBM has for, you know, a salesman spends two thirds of his first two years in school getting even with Axel Wennergren's famous bank account, couldn't make the grade. And then it wan all kind of quiet for awhile, and then more of the biggies began to get in. So you had General Electric, who exercised almost a solid ten years of ineptitude, and RCA with, you know, much more marketplace savvy but profits just as lousy, and the in on the other side of the coin the ones that had all the chips stacked against them, apparently, and were great successes. Like Control-Data Corporation and XDS. You ask, you know, "Why on earth did that happen?" Well, I think the reason it happened is that if you take Control Data, it's got Bill Norris as a consonantly excellent computer man running the company. And the same for Pilowski at XDS. General Electric tried to run the place with a general manager who was probably an expert on storage batteries or light bulbs, and had a lot of seniority and again wouldn't know a computer if it fell on him from a second-story window. And I this the time had passed when you could do that. You can't really do that anymore. In fact, I doubt that you could start a computer company and do anything but go bankrupt anymore, because the technology is such that now you've got a capital investment beyond belief to be able to get into the marketplace. So the days of the land boom are gone. It's not around here.

And you could say, "Gee, you know, a large number of people relatively got wealthy doing that," starting with John Parker, who was I guess relatively wealthy before he began, even. But the number who did is probably miniscule compared to the number that didn't. Who thoroughly indoctrinated and brainwashed, and when he gets out, he may not be a genius, but he sure as hell knows that it is he's supposed to say if he has any kind of memory at all. So you could say that. Strikes me as a company that's had a congenital problem getting organized, you know, figuring out what it is they were trying about the West Coast industry? Do you feel that significant things have happened on the West Coast as far as pushing the computer industry, advancing it?

GRANHOLM:

Oh, sure, particularly a lot of big users and some companies got into the computing business and got out of it. There was Northrop whose work really was sold out to Bendix, and then sold out to CDC. The fact that IBM has one of its largest research labs on the West Coast is, I think, significant. The fact that the origin and really many of the thrusts of Burroughs in the computer market has been on the West Coast and that is significant. Sure. I don't know that there is a geographical thing you can attach to it except that it seems to me that mostly the engineering developments have happened on the West Coast and on the East Coast, with a great desert in between except for Minneapolis.

MAPSTONE:

Yes, and that's really a pure case of geography.

GRANHOLM:

Maybe.

MAPSTONE:

Did you know Floyd Steele?

GRANHOLM:

Vaguely, yea. But I didn't . . .

MAPSTONE:

I mean, do you have any feelings about his contribution?

GRANHOLM:

No.

MAPSTONE:

None.

GRANHOLM:

I know a man that does.

MAPSTONE:

Who's that?

GRANHOLM:

Gus Pearl.

MAPSTONE:

I don't know.

GRANHOLM:

He's over in Canoga Park. I'll give you his…84776

MAPSTONE:

4776. And what's his connection?

GRANHOLM:

Well, he was the financial vice-president of one of Steele's companies for a number of years.

MAPSTONE:

Oh. Do you know which one? Decker? Luder? No. Mobil something?

MAPSTONE:

Oh, Modil.

GRANHOLM:

Modil systems.

MAPSTONE:

Modile Systems, yeah. Say. How about Hagen? Did you . . . ?

GRANHOLM:

I don't know about Hagen.

MAPSTONE:

What about in the sort of software developments? What would you say was the significant breakthroughs?

GRANHOLM:

Oh. [pause] I don't know. I don't think I even want to have any opinions on that. I'm not sure there have been any that I consider really significant.

MAPSTONE:

Well, we talked a little bit about some of the significant developments--That's because I have a view that a large part of the need for software comes from the fact that computers are designed stupidly.

MAPSTONE:

Oh. Would you like to enlarge on that?

GRANHOLM:

Yeah. Well, you know anything about logic design?

MAPSTONE:

A little. Not much.

GRANHOLM:

Well, it's a job essentially like programming. You can build in hardware anything you can program, really. And the fact that early computers were designed the way they were sort of set the pattern for those machines which succeeded them. For instance, you can go out in the world and find programmers who, I'm sure you'll still find some who will tell you that thirty-six bits is the standard itself. That's the way you ought to design a computer, okay? How did computers, particularly IBM computers, get to have a thirty-six bit word? They got to have it because the original memory in the 701 was an electrostatic tube, and that happened to be the number of spots that you could write across the two-inch tube face without having them start to degrade to the point where it couldn't

accept them any longer. That's now thirty-six bits got to be a designing. It has nothing in the world to do with how one ought to design a computer. It was a physical constraint. There is no real reason that computer aggresses need to be wired into a machine. You know, we now have the alleged great breakthrough of virtual memory in which you wire it with any old address and you mold it into some real addresses. And there's hardware in the machine that does that particular locating of bringing in a tube which sets under virtual, puts in actual, re-writes it back into virtual. But there's no reason that you can't wire virtual memory in which you change the address structure of the machine from the top. Microprogramming is supposed to be another great thing, you know. You take a micro= program machine and you put in the contents of the fast read-only store, and that determines the logic of the computer for that problem. That's also a program. And if you discard the speed, and now we've got technology for high-speed read and write memories, you can even point…ought to have let the logic on a computer with every problem. People done these things with hardware, because if they had have done these things in hardware, that has generated the need for a lot of different kinds of software that are elegantly done, I'm sure, and many people spent many hours writing out and checking out successfully and unsuccessfully and fill journals with learned papers on it, and they make a good case for saying that the whole thing is sort of more work, because the machine wasn't designed differently to start with.

MAPSTONE:

So what you're saying--I think what you're saying--is that . . .

GRANHOLM:

Part of the programmer's job consists of, you know, he's got to have a delivery van, but he's been issued two bicycles and he's got to industries now got such an impetus to go in the direction its going. Is there any likelihood that it would stop and look at the impetus and see? Oh, no. No. It's got many idiocies welded into it. I reach in my checkbook and take out a check and it's got magnetic character recognition on the bottom, you know. And every bank in the world has that, and they have that because Bank of America footed the bill to do it, really, and then sold the project to General Electric. So the whole world uses magnetic ink. Optical recognition was just as well-developed in fact, came along before magnetic ink character recognition was done. And if that were used, we could use an ordinary topographer's fount…readable by any human being as well as any machine, and we would have eliminated the cost of magnetic ink, special type founts, and revision of printing technology in order to have checks processed by a machine. It didn't happen that way. And it's never going t o go back. The stupidity is wired in now. There's no way to get rid of it, unless someone wants to pay to revise all the bank systems.

MAPSTONE:

Never happen.

GRANHOLM:

No.

MAPSTONE:

What are some more stupidities?

GRANHOLM:

Oh, I don't know. It seems to me that's a large number. I'm sure there are some more. I mentioned there was design of computers that worked in the space vehicles. Ah, well there have been formats and media invented to do things not required, maybe because someone needed a job. Many of those have died of their own weight. You may or something of that sort, because someone believed you needed that for the data density. It turned out that was not so. Unfortunately, preliminary design and conceptual design are two areas that tend to get filled with idiots that no one pays attention to them, because they only start getting interested, management and money people, when you get to the stage of engineering prototype and they've got a lot of money in this area, because you go out and produce five hundred machines and, you know, they pay no attention to whether you might be producing a Model T Ford and there's no market for it anymore.

MAPSTONE:

So it's really an industry that's kind of got locked in its own impetus.

GRANHOLM:

Yeah. And I'm not saying that computers are bad. The fact that they are fast and versatile can cover up an awful lot of salients. Well, I can think of an example design. This same computer with the submarine door? Okay. Works from a punch tape system. Uses Pando(?) 5 Mobile punch tape, or some versions of it. That tape and its format have been jelled since 18-something, were first used in the French garment industry to control knitting machines or automatic looms or something of this sort. I've forgotten what Mr. Baudo invented. You can look him up in the dictionary.

MAPSTONE:

Sounds like a sort of jacquard…but in a later version.

GRANHOLM:

Right. So here's a tape format that's universal, you know, used all over the United States and all over the world well-known. Buy all kinds of equipment to do it and consider how you punch tape. You sit down at a thing like a typewriter and you can punch tape, from the first character to the second character to the third character, fourth and fifth and so on. That's a serial string. Each character is one or one combination of five possible holes on

the tape. So if you get two to the fifth, you need characters that can be punched over a key strip. That's not enough for the alphabet and the numeric, so we devote some of these characters to shift upper and lower case, and some mean that, then if this character comes along, shift upper case, then all the characters that follow mean something different until you reach lower case again. That's the way you can get all that information in five possible punch positions. The computer which was designed to read that tape had a built-in, wired-in loader. Okay? This is a machine that can read in the Baudo code tape, and start some here and start on a program so that now you can begin to operate. …went in the bottom of the computer…the next one went in the middle, and the next one went to the top. Now we've succeeded in splitting the three Baudo characters so that they are reversed in their normal order. The first one which we ought to read is lowest in the word, and the middle one in the middle and the last one is up at the top of the computer word. Not only did it do that but it turned the bits around so that the first high order; bit in the Baudo code…last in the word so it, you see split the word in three parts and reversed the order of the parts, and then reversed the order of the bits with in the parts. Now that's a design from the standpoint of stupidity, because now someone has to write a long extensive program to unscramble this whole mess once it's been read into the computer. And everything that's read in goes in that way. So all this great time, operating time plus program in time, taken to unscramble something that was pretty damn simple to start with and should never have been messed up. So we've got an idiot designing the input book.

MAPSTONE:

Sounds remarkably like an analogy that comes to mind, is the rotary engine and the piston engine, in a way, you know. The piston engine goes up and down to make something go this way in a circular motion.

GRANHOLM:

Oh, yeah, maybe. Piston engines happen to work much better than a computer works. I would think.

MAPSTONE:

Obviously.

GRANHOLM:

Or we'd be in real serious trouble. I point out to you one of the reasons that this happened. Okay. The order of the bit got reversed in the computer ware? Remarkable story of how that occurred. The man working on that system did not know how to load the reader properly to punch paper. Then he got an extra half twist in it so he was reading it upside down at the time he did the design. True. Swear to God it was true.

MAPSTONE:

Dear, oh, dear. I'm going to give you one wish, a big wish. What would you like to have seen happen. How would you like to have been the industry?

GRANHOLM:

That would be a presumptuous thing because it involves so many people and now so much of our national economy. I have a much less earth-shaking wish, I guess. And I could pick many examples for this. I would like, for example, to have had a year as president of Sperry-Rand or General Electric to see what could really be done with the great money and opportunities that were in those operations. And I think a tremendous amount could have been done. Probably from the standpoint of much better competition, better benefit to the world maybe. I don't know. But I think that for all its virtues--and perhaps there are very many--it's always a poor thing to have the marketplace dominated by one company, and IBM's dominating it since the beginning. And they've dominated it largely over the incompetence of their competitors, be cause of that.

MAPSTONE:

That's not the best reason for dominance.

GRANHOLM:

No. However in spite of that, if I were going to call someone to get the job done why, I'd probably call IBM first. I don't know if it's any better than it was.

MAPSTONE:

Did you know Paul Armer?

GRANHOLM:

Oh, yeah.

MAPSTONE:

Paul sort of, comes through in my talks to people as someone who has really had a lot of weight in the computer field.

GRANHOLM:

Um-hmm. Yeah, that's true.

MAPSTONE:

Would you?

GRANHOLM:

Oh, yeah, I guess so. Well, he's a very competent man, expresses himself very well, was interested in being on committees and talking to people. I guess that adds up to having a lot of weight.

MAPSTONE:

How about yourself, apart from--I know you had the Computing, Computing News, did you call it?

GRANHOLM:

Yeah.

MAPSTONE:

Do you think you have sort of had any weight, or some weight, in showing people directions or maybe exposing them to some of their own idiocies?

GRANHOLM:

Very little. People don't like to be exposed to their own idiocies. It's a very unpopular thing to do.

MAPSTONE:

That's right.

GRANHOLM:

No. I think it would also have to be…in effectual if you try things like that. I did a consulting job for a company who built large ground-based computer systems that were used in air defense. They were having terrible time trying to pass their acceptance tests and it became obvious to me that they had no testing facilities for their products. So I suggested to them that they establish a product-test function that could carefully wring out everything before it left the place and went to the customers, and that the people who work on product test not be the same ones who designed and built the machinery. Not a particularly unique idea. It's done it for lots of years because they don't want to deliver cards to the customer's premise. I might as well have hollered up a pipe for all the effect it had. The way they did it was obviously too entrenched to change.

MAPSTONE:

You mentioned that you worked with TRW. What were you doing there?

GRANHOLM:

Right. Well, having opinions. Preparing briefings for people and this kind of thing. A vapid job, really.

MAPSTONE:

This was already when it was TRW, so this was quite late, right? It was long after the Ramo Woolridge split.

GRANHOLM:

That's right.

MAPSTONE:

You talked earlier something about process control. Didn't TRW get into that?

GRANHOLM:

Oh, yeah. They were very early and…But I didn't work in this. You'll have to talk to Dan McGurk if you want a background on it.

MAPSTONE:

Which companies have been out in the forefront of the process control work?

GRANHOLM:

General Electric. I don't know that they paid all that much attention. Ask Dan. He'll tell you. Do you know where to find him?

MAPSTONE:

I don't have a number for him. Can you give me one?

GRANHOLM:

Yes. (pause) 990-0510.

MAPSTONE:

Is it 213, Los Angeles?

GRANHOLM:

Yeah.

MAPSTONE:

You said something before about the Astro-Data Computer, or Astro-Data Company? I'm not familiar with them.

GRANHOLM:

Oh, they were a big electronics company in Orange County. They had about seventeen years of successful work. They built the memory for the first Johnniac and all kinds of things. They went down the tubes about two years ago…One of the leading bankruptcies in Orange County.

MAPSTONE:

The memory for the first Johnniac, wasn't that--I thought that was the Paramount, Teleman and Leonard.

GRANHOLM:

You may be right. They built some things for them. They stem from about that time. Yeah, Telemeter Magnetics. I guess you're right. They probably--no, they built the first core memory for the Johnniac Astro-Data built that.

GRANHOLM:

I think they may have, or the head of Astro-Data designed it, or someone up there, not long ago. Think like tool. There was some kind

MAPSTONE:

But it was a . . .

GRANHOLM:

A specialty shop.

MAPSTONE:

A specialty shop. I was trying to think of a good term for it. Okay. They didn't make the mistake of what J. B. Ha! Did…of trying to build computers? No, they made other mistakes.

MAPSTONE:

Okay, what were they?

GRANHOLM:

I don't know. I wasn't there. But they made the mistake of going bankrupt. That's a fairly important one.

MAPSTONE:

I'll say, yeah. Okay. Well, let mc ask you something. You've sort of been looking in on computers for a long time. Is there anything you feel like adding to this area? What would you like to personally put on the record or make a comment on?

GRANHOLM:

I'm. Well, it seems to me in some ways kind of interesting that the computer industry has developed the way it has that is not in keeping necessarily with the Jules Verne type predictions. When you look at the funny papers of the 1930's, for instance, at the Buck Rogers strips, it was presumed that the development of devices would begin with robot-like machines. That hasn't happened. We don't have those kinds of machines. I see computers starting to be applied to very real and pragmatic jobs as opposed to just bulk computing in ways that I think are significant and most interesting. And one of the ones I would say is the control system monitoring loop on the freeways in L.A. They've got the San Diego Harbor and Santa Monica Freeway triangle monitored by computer now, and with feedback, feedback to the observing helicopter and to the state tow trucks and now to the signs for motorists, warning them of freeway congestion. Beautiful application well done as far as I am able to tell. Highly pragmatic. Great application of computers ! There are lots more of those they're not going to happen for a long time because there's no business pressure or the people just aren't…to do that until they die and the deck is taken by someone else. The real estate industry is a good example. We should really have all the listings in…Valley, of which we have about half, in a computer bank, retrievable so you can push them up on a desk set. That's not going to happen. Nobody wants to go do that first in the real estate business. There are lots of similar businesses that are not going to feel any impact for a long time.

MAPSTONE:

Is this just a sort of built-in resistance to technology that it's not going to happen?

GRANHOLM:

It's not only that. It's the fact that in the real estate business, practically everyone really works for himself. You see, we've got an office here, the residential office, right there, through which you walk with twenty-five people, and they're all independent contractors.

They are all on commission, strictly; nobody's on salary. And they don't want another two percent of their overhead going into a corporate…and deed development. That's the last thing they want taking hold, you see. So in general, that's the way the real estate business is organized. But that could change drastically as the insurance industry has changed drastically. Because it used to be that way, and you find now probably there are more insurance salesmen that work for companies than there are who work as independent agents. Because Allstate and State Farm and Farmers of Los Angeles don't have**…**They're on salary and they are all out there under the company ground rules. You think it will, in time, evolve into this business? I think it would in a hell of a big hurry if Sears & Roebuck decided to go into the real estate business.

MAPSTONE:

Really, that's all it would take.

GRANHOLM:

That's about all.

MAPSTONE:

So that basically the only applications are very simplistic or

GRANHOLM:

Oh, many of the simplistic ones have been overlooked. I mean, you know, we know how to do the ones to get Apollo to the moon and back. Never mind how that could have been done better. That worked very well.

MAPSTONE:

It sure did.

GRANHOLM:

It could have been done much better but, you know, I wasn't on software and hardware design for Apollo, and I'm not necessarily going to criticize the guy who was, because he had a lot of considerations that had nothing to do with soft-ware and hardware.

MAPSTONE:

I suspect that one of his ground rules was not to push the state of the art, but to 3ust work within it, maybe.

GRANHOLM:

I don't know. The other mundane, pragmatic, every-day applications need a great deal of improvement. I cite an example. Be done basically, but I don't know if we could afford the because meter-readers are still available and cheap. But even though the capability is obviously there, as far as I know in those kinds of programs there are no checks and balances on the input information. Now let's assume that you've a gas meter or an electric meter and the meter-reader reads it wrong one month. The typical way he's going to read it wrong is that he reads you've used a thousand cubic feet more gas than you actually did, and he writes up that. That comes out in the wash the following month. So you get a month in which you get a great big bill, and then you get months wit h a very small bill. But the computer doesn't check the continuity, you know, to see if that's happened. It turns out the company…What do you want, Kirk? Probably owes you months... Are you bothering me? (pause in interview). But I wanted to tell about there is no continuity checking, and it could be done.

MAPSTONE:

Yeah.

GRANHOLM:

And the company could find its own idiocies rather than mailing them out. There are a lot of little improvements in the existing system to get rid of the statement from the lady of the department store that it's messed up because the computer did it, which has been repeated to the point where people believe it, I guess.

MAPSTONE:

Oh, sure. You believe it because you can't get any action, and you know, write to this dumb computer and you get back the same piece of garbage. I get angry, too Okay. Let me kill this.

[End of interview]