This is IBM Interview TC-50 in the IBM Oral History of Computer Technology, Larry Saphire interviewing Mr. Maurice Papo at Nice on January 29, 1968.

S. We want to talk about two th ngs today and one is the environment in which the early computer development in the late '40's and early '50's took place in France and what was France's reaction and secondly, the development of the WWAM machine. Why don't we just start off talking a little bit about the computer environment, if any existed, when you first came to the company. What year did you start working for IBM?

P I started working for IBM in 1954.

S. What was your background?

P Well I was just out of college at that time and had two engineering degrees, one from the .....
and one from the .....
and I had some computer training in my military experience which was anti-aircraft computers and I joined IBM as my first employer. Now at that time IBM had the 604 in the market and I understand the 604 was very successful in the United States but was not so successful in Europe and mainly in France and Germany. Now the reason for that is because of competition from a company named Bull and Bull had come up with several things which made life

difficult for IBM. One was a computer named Gama III which was clearly superior for the money to the customer, to the IBM 604 but that was not the main problem. The main problem is that this computer had the ability of having a tabulating machine connected to it where IBM did not, on the 604. And that was the environment. Now the IBM environment was also interesting to note and that is that during the war, IBM France had been cut off of course from the United States and in order to be able to live had somewhat doubled up the small kind of laboratory and just after the war the import restrictions made it quite impossible to import the 407 tabulator from the United States and the tooling of the 407 tabulator, or tabulating machine was so it would be too high to be justified in the European market. Therefore we were in a situation where there was a need for a tabulating machine similar to the 407. We could not import the 407 from the States and we could not afford the tooling to manufacture it in Europe. So the French laboratory at that time learned to double up the tabulating machine which had roughly the same characteristics as the 407 but which had .... or which required less tooling and came up with a mach ne known as the 421 which is still widely used in Europe instead of the 407. So there was this know-how available in the IBM enviornment and this pressure from competition.

S. When was the 421 developed, in what year, do you recall?

P. No I don't. I don't think we would have too much trouble finding it but I don't have it at my fingertips.

S. Did you ever find out why the 421 required less tooling?

P Oh yes, because the tooling problem was because of the print wheel of the 407 required extensive tooling and the 421 was based on an upgrading of the type bars. .... was based on an upgrading of the ..... bars which were already used in the .....

S. Which you had resisted already.

P. The tooling somewhat existed but the modifications to that tooling were not as important as the new tooling of the 407. But it was a new machine electrically quite a different machine from whatever existed before, with tooling and engineering work I mean.

S. This report that you just gave me to read earlier today mentioned something about there being less of a need for speed printing in France than in the United States. What was that a function of, that need for a lesser speed of printing?

P. I don't really know and I'm not sure I agree with the statement by the way.. I don't really know. The point that I was making is that there was a need for something different and that that need occurred in two areas.

One is the banking area. Banking in France and in Germany is much more complicated than banking in the States, and the availability of that Bull Gama III hooked up to a tabulator made dealing with those banking problems much easier and therefore there was a strong pressure to have the same thinking here.

S. That's because they compute the interest daily, is that right?

P No, it is because of a very complicated th ng. First of all, they have a totally different way of computing interest. I think if we take one example it is called the ..... which means that your account can be debitory which is never the case I understand in the States. You can owe the bank money at some times.

S. It is now with the credit system.

P. But the interesting part was that it wasn't at that time, the interesting part is that if you owe the bank money for one day, you pay interest as if you had owed that money to the bank for the full period under which they compute the interest rate. And therefore the amount of money on which you pay the interest is the highest amount that you ever owed to the bank during that period. So first you had to determine and let's assume you do that during six months, you had to determine during that full year which was the day at which you owed the bank the greatest amount of money and after you've

you've done that then apply the interest rate.

S. That's pretty good for the banks.

M. It's pretty good for the banks ~~but~~ and that happens to be the system they were using. This is only one aspect. The banks in France do lots of things that banks don't do in the States. For instance, all the banks are brokers. You go to the bank and you can buy stock of any kind. They are regular brokers. So it is a more complicated thing. The next application was the electricity billing which was in some ways complicated and could make use of that hook-up of the Gama III to the tabulating machine. Then the Bull had also other advantages because they had some mechanical links between the tabulators and the summary punches which made possible to key punch summary cards without loss of cycle. All this is going to the same direction which is that their machine was more efficient. And also to the fact that although the domestic organization could use that equipment, they didn't have the same pressure for having that. So that's the environment from the market side. From the engineering side we see that IBM France there is some engineering talent and they are ressenting that pressure. So the idea came to respond to that pressure by doing several things and they undertook to first hook up the 421 to the 604 which they did, and that was a very successful counter-measure to the Bull Gama III tabulator hook-up. Then they found that the

memory was not enough and they devised an additional relay memory to increase the memory size of the 604 within the hook-up.

S. Was that a special French development?

P. Yes it was a special French development but sold all over Europe because Bull Gama III was sold over Europe and that thing was responding to this.

S. What was the memory called?

P. I think it was called relay memory. I'm not sure.

S. Was it a box?

P. It's a box with relays in it that acted on memory.

S. Did you work on that by any chance?

P. I did work on it at the end of it. I worked on the modification of the 604 and on the hook-up and on the insert relay.

S. Were there any problems with that hook-up of the 421 and the 604?

P. Well not really except it was a patch job where you add someth ng to existing stuff without really thinking it through from the beginning. In other words, it is a good counter-measure to a stop gap kind of situation but not a very intelligent long range plan.

S. Were you familiar with the CPC, with the Card Programmed Calculator?

which is a hook-up between the 403 or the 7 and the 604?

P. That's right but that was a much more expensive machine and was not really directed toward the same market at all. Now for the same reason again, the French laboratory at that time worked on another machine which was the 626 and that machine had electronic computing ability put into a 402 calculating punch, the same thing again, answering the pressure from those who had no off-line summary punch, etc. We did include also the 421 tabulating machine which as I recall corresponded to the 407 by doing several things to it. We added electronic ability and that made the electronic 421 in it. There was one version called the 441 with two reading heads, again to try to follow that very hard competition from Bull and the pressure from the market to meet it someplace. They really wanted something more sophisticated than just the 604 that IBM was offering. So the more the laboratory was working on patches, the more the management of IBM France became concerned about the fact that something should be done in a more orderly and long range plan way and there were a lot of meetings between the French company management and the IBM management in the States to the effect where the French management were acting as what we would call today Product Planning functions, were trying to convince the IBM Corporation that it could not possibly be that such needs exist in Europe and not in the States. They

would happen to come out some day in the States and the sooner we work on it the better we'll be prepared. And finally that point came across and the decision was taken in a famous conference. I don't recall the name .... it was in some hotel in New York and it is referred to by very many people as the Hotel, whatever the name is, conference where the decision was made to explore really the possibility of doing something which would be a long range plan to solve that Gama III competition. Now what's interesting is almost the same time came the transistor technology. Now not very many people in IBM knew what transistors were nor what the cost would be, except we thought it was the answer to all problems. And at the time when this study was launched for the new machine, we didn't know really what it was going to be but it had to have computing ability, printing ability, summary punching ability and the idea was well if those transistors are cheap, let's have an idea and I will look at the possibility of building this new machine transistorized. So a group of people .... of systems people came from the States to Europe and gathered with a group of people from the European laboratories and mainly at that time Germany and France, to see what could be done in that area. And there there had been several different directions which had been explored at the same time. That is what makes the history a little confusing. What direction of the technology direction do we use for

..... circuits? Do we use transistors or tubes? Many people today forget that we looked at the possibility of using tubes very seriously and decided on transistors because of wrong information we had which is very funny. If we had had the right information at that time we might have taken the wrong decision because we thought that transistors were going to be much cheaper than they actually were at the time when we started building the machine.... But on a long range term as you know, it was still a good decision. But we looked at tubes and transistors from what we knew, and that was very little. It is important to note that it was very little systemswise that we knew.

S. What made you think that transistors were going to be cheap?

P. This was an assumption, that people coming from the States were the only ones who had some experience or at least some exposure to transistor circuits and they came with some assumptions. We decided we're not going to discuss the assumptions and one of the assumptions was transistor cost. I don't recall what the figures were but we probably could find them out and we took those assumptions and worked for this from there. But that first direction was electronic circuitry technology. The second direction was logic, architecture of the system and the third direction was I/O, what kind of printers, etc. will you use? And as far as I/O is concerned, we came

As far as I/O is concerned, we came very quickly to the idea that the best mechanical experience was in the German laboratory and the best machine to be ..... was to be based or expanded from a stick printer project where one stick was spinning around printing in the space. So the German laboratory was given the responsibility almost from the start to work on that printer/reader and the speed had to be clearly faster than anything we had and we decided to shoot for something in the neighborhood of 300 lines per minute. Now remember we were at 150 so we felt this was good enough. And that was settled pretty fast although that project never went further than building one model which had been tested with the WWAM machine. That was not successful but it was the first decision that we reached as a group. As far as the figures were concerned, we had had lots of direction. First we thought we were going to use handmade circuits, you know, each group building its own system. And the first estimates which were done actually implementing the logic approaches were done by each logic group debugging the transistor circuits. Later on I'll go back to the logic afterwards because I think that's the main point, later on when the German/French/American group moved to Endicott and Poughkeepsie in order to further study the thing, then we had exposure to a circuit work which was done in Poughkeepsie which

was called the MAC Program. MAC was Modular Accounting Calculator or something like and that was a series of standard circuits that we were going to use. So that was the second decision. We were going to use those standard circuits.

S. Transistorized?

P. Transistorized. We practically didn't spend too much time on tubes. It was really a very soon decision to use transistors and later on among the transistor circuits, to use the MAC Program circuits. Now the logic to be used had not been decided so easily. There were three approaches to the logic. Two of them were a fixed word length, that was the American and the German and they differed from the architecture within the machine. The French proposal was a variable word length with something really new in the concept which was it was a plugboard machine that we came out with at the beginning to be able to do with one plugboard as much as possible. That was the problem. The stored program machine was investigated at the very beginning of the project and we still have estimates in the file and it was ruled out because of the cost of memory. Therefore we said it had to be plugboard. On that plugboard the big problem is a 421 plugboard or a 407 was already a mess of wires. So what can you do when you already have a mess of wires like that? And that's when the first idea came we're

going to have a plugboard where you plug in only the exceptions. So we're going to devise a machine which has been ..... to do automatically most of the jobs which normally are done and you're going to plug the exceptions. For instance, if we have variable word lengths, then we'd better start add at one position and the machine will go now on adding until it hits the exception which will tell it to stop. You don't have to plug every position. On the sequence of the program steps, the machine will follow the sequence 1, 2, 3, 4. It's only when you hit a change that it will not follow the normal sequence and that reduced the wiring of the machine tremendously to the point that on a regular 421/407 plugboard, we could have three readers, one punch, one printer hooked up to the computer and that was just completely impossible with the old technique of cabling every brush, etc. And that I think is the main change in the philosophy, looking for that way to give instructions to the machine with a minimum number of wires led to the development of the logic of the one machine as it was. And the day the cost of memory changed, which incidentally happened to be also the time at which the cost of the MAC Program circuits started to change also, made the one machine not ..... any more because the circuit cost went up and the cost of memory went down and the group in the States

now picked up this th ng, saying now we have a different economics problem now. We can afford memory so why bother with all the contact problems of having a plugboard. But we can still keep the same logic in order to make within the machine the greatest efficiency of both the memory and the instruction set.

S. The cost of the logic went up because of the transistor cost that had not been foreseen.

P. No because the MAC Program circuits had been dropped. That program was dropped and therefore you had either to pick up the whole program cost of one mach ne whereas before it was supposed to be spread over a series of machines.

S. I see.

P. And that's the same time that the memory cost went down and SMS circuitry went up.

S. And SMS circuitry was going up simply because we hadn't found out how to make transistors .....

P. No because the MAC Program was just not a good .....

S. I see. The circuit design was the problem. Well since these unexpected circuits...circumstances... why wasn't the decision made at that

time to switch the whole logic to WWAM which eventually of course was done in the 1401, right?

P. I'm not sure. If you look at the 1401 logic ..... if you had taken the WWAM there are two assumptions. One, change it into its old program and that is quite an assumption. (change it into a stored program...and that is quite an assumption) That is quite a change. Let's not minimize it. But that is because memory cost had gone down. Everybody has always agreed from the beginning that the stored program was better except that it couldn't be afforded in the previous cost. Now we can afford it so let's change it to the stored program. Second, change it so SMS circuits. Any group would have come up with the card version of the 1401. They make the step upward which is the tape version. But the card version of the 1401 I would say any group being given the job of taking the WWAM mach ne and changing it to stored program and SMS circuit would have come up with someth ng very close to the 1401. So it's not the same group and understandably so. Because at the same time in the States, there was all the experience of the SMS coming out and the people in France didn't have that experience. It involved a lot of experience going back over the oceasn that we didn't have and we didn't know how to handle that so well before and we

could have done it but probably not within the same time scale. And then it was still the practice in the company which has been decreasing nowadays, but it was still very strongly in force at that time to have some competition between the labs.

S. The old Endicott thing.

P And with that there was definitely some competition between the group in Endicott, who had lost the initial WWAM Program to the French and were pretty happy to take it back with a very strong systems advantage. So that is the first part of it. What that group has contributed terribly or tremendously is by seeing now that the fact that it had a stored program there was no reason not to limit to those three readers and printers that were planned in the WWAM and let's put the tapes, disks and all the gadgets ..... which made the 1401 a really powerful computer, instead of just an electronic accounting machine.

S. Well obviously this has occurred in the transition of ideas, right? Was it this difficulty in communication or this competition that allowed the WWAM to go on until it was finally ended?

P. No because the decisions were based only on ..... and that's a very important th ng. The basic costs that nobody knew, that's the problem. Nobody really knew the cost of transistor signals. Nobody really

knew the cost of memory. It was just projection. And depending on how you project, one solution was a good one and the other one was bad or vice versa.

S. Based on cost.

P. Based on cost. Now there were some people in the French laboratory who were very resentful of the 1401 switchover because they had gotten before and not very long before, an estimate of the WWAM cost if WWAM was to be so programmed. And for that cost estimate they had requested costs from the States because they were not allowed to make assumptions on cost, since the units were to be manufactured in the States. So they were given back unit costs for memory units and unit costs for circuits which showed clearly that you couldn't build the WWAM with a stored program. Now two months or six months later, I don't recall the time scale and it does not matter, you see a project coming back from the States, saying fellows we can do twenty times better with the stored program because now it's cheaper. Now it's cheaper because some other projection has come up and some new developments on which they had no control on this side of the ocean or no knowledge as a matter of fact.

S. Well what was it that made memory cost cheaper?

P. I don't really know. I don't happen to recall.

S. Well when you found out that suddenly memory was becoming cheaper and transistor circuits were becoming relatively more expensive, now I may have asked this question before but what was the reaction here when that move came or didn't it come clearly enough?

P. ..... Well honestly I think it is reasonable to say that there was some hard feelings but whether it is true or not, it is impossible to define. I mean how far does reasonable competition between laboratories go? This is something that cannot be really determined or assessed with that knowledge. But it still remains the basic fact that with this new technology -- SMS -- and the new memory that was coming out, even if the management had been willing to, I don't think that it was possible to make the 1401 development with n the same time scale in France because it was not firmed yet and those things were going in parallel in the States. Where here they needed to be firmed before they could be transmitted back across the Atlantic, etc. And one of the lessons that we learned from that story is on how to improve communications in order to avoid this problem in the future. And we've been very slow in possibly improving that but I think for instance today we have come a very long way into improving that communications pass to the point that if you take the 360 story, the first 360 unit to be put into the customer's hand was the 360 Model 40 and it was

engineered in Europe which means that that lesson had been good enough so that ten years later we were able to overcome that basic fundamental problem.

S. Well why do you think that problem existed? Was it simply because of the competition?

P. No I think the communication links were not established as well as they are today. And we were just at the beginning, remember? A few years before there were no communications whatsoever and it was just after the war and no communications at all and they were just really starting and lots of people didn't realize that we were in such a mode of flux. When the engineers came back from the States with the MAC Program circuits to Europe they had a nice, well-bound book. I always remember it was a red book with gold .... the letters were in gold on the cover and it said "MAC Program Circuits." And the guys thought that this was it. If we spent so many dollars developing those circuits it was impossible that the company wouldn't go buy those circuits. And therefore they didn't even bother periodically checking whether this was still the answer. Today if we have a program similar to that one, or when we had the Model 40 program in England, we had one guy of the team in the States right in the circuit group to get the last minute information as to whether those circuits are changing or not. If the availability date is still the same, if the cost of that circuit is still the same, if the cost picture changes, then he'll phone back and say, fellows you may want to change

your logic because the cost of the circuits is changing. And we just didn't know that at that time. We were just learning. We thought the book was well-bound and that was final and the price tags were given with the book and we thought this couldn't be changed a bit.

S. Well of course this comes from depending on the States for various components, right?

P. Right.

S. So that you also depended on the States for accurate information concerning the cost of them.

P. That's right. It is still very much the case. It's not completely the case. But now we know how to handle that problem and before we didn't.

S. And that's why you're always traveling around so much now.

P. Unfortunately I think this may be one of the reasons. Now it's funny, it's not the same problem but it may relate to it. It seems to me that there's one study to be made on how people can communicate and it probably is to everybody that something that we have to handle by mail may require months to be settled or if you write cables it may require weeks and if you pick up the phone you may do it in several days but if you have the guy in front of you, you may do it in a few minutes. And this is not because of the turn

around time of the letters, it is just because apparently there is something beyond what you write which makes people who are one in front of the other comprehend what the other guy is meaning. And if IBM has any way of better understanding that process, in order to eliminate the need for people to travel across the ocean in order to get themselves understood by meeting, then we would save the company a great deal of company money and then probably improve our growth tremendously.

S. And not only on the technological problems....

P. On all the problems, on all the problems. Whenever the problem is very complicated, not because of political reasons or personal feelings, it is just a complicated problem technically or any other way, if you start writing your opinion, first you take a long time to write it. You're never happy with what you've written and never reflect your opinion the way you should or the way you think it should. And then when the guy on the other side of the ocean reads it, he doesn't understand exactly these things that you wanted to write. But if you put those two guys one in front of the other in ten minutes they understand each other, even if one doesn't speak English very well. It is interesting to try and understand why this is so.

S. And this is precisely what didn't happen with the WWAM Program.

P. And that's what then happened. The group worked together in Sindelfingen at the beginning. Everybody worked together. In Poughkeepsie and Endicott it was still one group. And then at some point it was decided that all the decisions were taken. The WWAM way was the way to go. The WWAM logic was the logic to go. The German printer was the printer to go. The MAC Program circuits were the circuits to take and now everybody else went his own direction and worked on those assumptions as if they could never change. The German group worked on its printer all the way through. The French group worked on those circuits and that logic all the way through and nobody really was on top of deciding every minute whether this decision taken a year ago was still the right decision from the new facts or not and that was the basic error, in my opinion.

S. Well has the WWAM experience had an effect as you implied before on current ways of doing something? Can you trace that back to the WWAM?

P. Oh I'm sure it did. I'm sure it did at least to all the people involved in it on both sides of the ocean.

S. Certainly to you because you were deeply involved in it.

P. Oh yes and on both sides of the ocean. I meet people who have been involved in the WWAM Program every day and it has changed to quite

some extent their way of th nking. To the Europeans it has brought a better understanding on how to deal with progressive decisions, if I can call it like that. Asking yourself the question every day is my yesterday's decision still valid? And giving some of the domestic friends a new insight on how things can be done in Europe and different ways of thinking.

S. Nevertheless the WWAM in those days continued on beyond the point .....

P. It did and that's an interesting point too because if you're really really trying to trace why it did, I'm not sure I have the right answer. Part of it is because of that competition. There were still enough feelings that they wanted to prove kind of in the French laboratory they could build this machine and make it work. And as a matter of fact, it was used as the laboratory computer for two or three years after completion. ..... The only thing which didn't work in that prototype was the German printer which had too much servicing to be done. It needed too many improvements which were not justified when the program was dropped, which could have been incorporated but were not justified. So in order to have an output, a 421 was hooked up to the electronic unit of the WWAM and that was used as the laboratory computer for several years. As a matter of fact, the basis

for the early work that was done in the French laboratory on line tests and modems, used the WWAM for determining all the subsequent line characteristics all over Europe .....

S. So WWAM was basically conceived as a commercial machine.

P. Yes. It had computing ability.

S. It had scientific ability.

P. Well it applied the same ability to the 1401. Remember the logic is very close to it, very, very close. It is extremely different at first because one is stored programming and has lots of other possibilities because of that. But it is a translation. Now another possibility I was referring to is why this program was continued. It is just because maybe management wasn't so sure about the account trade-off. I don't know. And if the account trade-out's were not right, you might have one or two go back to plugboards. So I don't know what part of that is true now or what influence it may have. And a third possibility which certainly was in there is that there was enough good work done and put into the WWAM machine itself so that it would be documented and tested out and there have been a very large number of reports written on the WWAM tests with results. By the way, the MAC Program, the circuits in the MAC Program did not go to the point of defining also the packaging.

And the French group had therefore to work on the packaging. And they worked ..... packaging which has a lot of similarities with the present SLT packaging. Of course every proportion being kept. It's not as good. It has two thousand drawbacks. But if you think that this was done in '56, it was very advanced packaging and that brought also a number of good experiences and interesting test results on packaging.

S. Did that have any influence on the results of SLT?

P. Well SLT is still much afterwards. It couldn't really have any influence except through people who worked on one and had that in their minds. But no direct influence.

S. There are two things I'd like to talk about and that is one, print-editing device and two, the parallel between the WWAM logic and the 1401 logic.

P. Well on the print-editing again it was forced by the rule I gave you at the beginning. The idea is to plug only the exceptions. You can't afford to plug everything. And if you look through all the print-editing instructions that were built on the one, you will find that this is their motive. The second thing is the scanning backwards and forwards eliminates 0's and inserting codes is also being brought out by the need of having a nice field printed out

..... printed out with 0's suppressed and the fact that it was variable word length and you didn't want to plug everything. You can trace practically every gadget if; I may call it like this or every appealing thing on the WWAM logic to the fact that we wanted to take every advantage of every memory position we had because this memory was expensive and therefore variable word length, every plugboard we had because one plugboard was expensive. It was expensive two ways. One because pulses going through were transistor pulses and therefore required voltage contact and second because in order to draw all the ..... of the wiring, we had to have power transistors at the end of each hub. Therefore we had to make every hub worth its money and we had to make every position of storage worth its money. And all the logic is built again around getting the most efficiency out of each memory position and each plugboard hub. And of course when you take that and you put that into a stored program, you get efficiency into the stored program.

S. So this was done.....

P. The logic.....

S. How was that done?

P. Well I couldn't really comment on that because I was not connected too closely with the translation to the 1401. I can tell you that the guys in

Patent tell me and seeing it with a Patent eye and that's a different way than an engineering eye, they say that the 1401 logic is fully covered by the WWAM logic with the exception of a few improvements on it but no basic patents. But I'm not really the one to comment on that at all.

S. Sometimes in machine development which tends to have to go along certain lines you get independent developments, even though they appear to be related on the surface, in actuality the guy who figured one out or the other out did not have anything to do with each other and they figured out independently. Was that the case with the WWAM and the 1401?

P. Oh not at all. The 1401 group was working with the WWAM group all the way through. It was the same group of peopleThey had constant drawings that we sent to them every week. They were kept up-to-date. They had the mission to be kept up-to-date and they had the mission to follow up the WWAM Program.

S. At this point when the 1401 was being developed out of the WWAM, were you still on that project or had you gone off to other things?

P. No I was still on that project. I followed it all the way through. I went to Poughkeepsie and Endicott and back to the French laboratory to build it.

S. And in the course of your American stay, what was the kind of work you were doing?

M. P. Drawing the logic diagrams in order to get a more precise concept and identify which was the final version to be used.

S. The WWAM or the 1401?

P. No, no, the WWAM or the German or the American version.

The 1401 didn't exist at that time.

S. And what was your experience in the course of this? Did you transmit ideas?

P Oh yes, that was probably one of my best experiences in the company. I happened to meet wonderful people during that experience and I wonder if they just happened to be wonderful or just the fact that they were different nationalities which makes the experience wonderful. But you learn a great deal when you are exposed to different ways of thinking, there's no doubt. And I'm sure you can get to anybody who was part of that group at that time and they will tell you the same thing. It was probably one of the best experiences in their IBM life.

S. Who were some of the other engineers in the United States with whom you had dealings?

P. Oh there was a crowd of them. I'll cite two interesting names. One is Chuck Branscomb who was on the 1401 .... the American version, and the other one is Bill Christensen (?) who was a product planner on the job. I knew both of them. And Carl ..... was the head of the German team..... There was a crowd of them. Ted Lassiter I just mention because he's now Director of Engineering for World Trade

was part of that group.

S. Well the print-editing device which you passed over very quickly is from what I gather, something that you had a very important role in. Perhaps you went over that too quickly. Was it mainly geared to the logic of the WWAM and was that where the editing function came in?

P. If you tried to put a 1401 logic, a card 1401, if you take a problem reversed, or if you take any computer, a 604, whatever you want, and try to make that a plugboard machine with all those possibilities, it is just impossible. So impossibility is mother of invention and that in fact, that print-editing function was found to be very useful, etc. and had its main reason into being very efficient with your storage and being very efficient with your instructions, the instructions being the plugs on the board. And that's all there is to it. You know you can do the same thing, you've been able to do the same thing before. It was no problem, in being less efficient. The big advantage of that print-editing as I understand it, is just as efficient in computer time and instructions and in memory space and that was the problem we were forced to be efficient. And we did it.

S. I see. Tell me a little bit about the final end of the WWAM.

P. I told you it has been built to be a prototype. It has been tested

and processed and it has been used as a laboratory computer for two or three years.

S. Where was the laboratory when the decision came to stop work on the WWAM?

P. The laboratory was still in Paris.

S. I mean in terms of the WWAM.

P. Well that was the biggest project of the laboratory. It was tops and I guess every time something like that happens you get lots of frustration. But that's the life of all projects which get started and you try to find out other directions for that project to be worked on.

S. Such as?

P. Well into small projects like the electronic .....

was one. I don't have all of them at my fingertips. There's something interesting, at that time the mission of the laboratory was somewhat changed. Somebody in the States decided that World Laboratories should do only experimental development, no product at all. Just get ideas, prove the ideas and pass it back to the States and I guess the WWAM was probably part of that. People felt that here is an area where the Europeans have proven their ability to get bright ideas and good systems ideas but they were not able to make

to make a product out of it because they were not able to follow tests on the technology change in the States. So from those assumptions you could take two conclusions, either to say well we have to improve the way that the European laboratories get aware of those technological changes or get the idea well let's forget it and let's let them have the ideas and make the product in the States. I think this is the wrong decision but it was taken for a while. So for a while the World Trade Laboratories had the mission of being only idea laboratories and that was called experimental development. Incidentally, this has very long reaching impacts. One of them is the reason for the laboratory to be down here in Nice. Because at the time the laboratory was to do only experimental developments there was no reason whatsoever for them to be near a plant and therefore when a laboratory location was picked out, the attractions or instructions were, don't bother with plant locations, just go any place else. Where today this decision has been vitally reversed and the people have realized that a laboratory ..... when it has a way to mature the ideas into products and some laboratories do suffer from not being able to apply the current thinking which is to always have a plant near by so that you can have the laboratory helping the plant and being helped by the plant.

S. In Research this idea was completely reversed. It moved away from the plant.

P. That's right. But this was experimental development and that was the idea. Isolate the laboratory. Let them have ideas and not be bothered by the facts of life.

S. For whatever reason in the United States, decisions were always taken to go along with the most advanced technology even when that technology such as transistors was still in difficult stages of development and of course that's the reason that the 608 which was a tube machine, was not continued on, because at about that time they decided that transistors would be the new componentry and in fact .... in fact the tubes that were in..... To what extent did that psychology have.... and here again I'm not saying it was a conscious thing but it just happened to be.....

P. I'm not sure that's true. I'm not sure that's true. I think that very often some people on the outside blame IBM for not being at the most advanced technology and if we stick to today's position some people blame IBM for not using fully integrated circuits to the biggest extent. ..... looking at the ..... picture. I think that's one of our greatest successes. We knew how to make integrated circuits by the time we decided to make SLT but we knew

also taking everything into consideration and especially the ..... the cost would not be as favorable if we had decided to go integrated so we cleverly I think .... the management of the company decided to take take advantage..... And I think the transistor 608 is a very good example of very good management, in my opinion. Now here is a new device like the transistor. It has tremendous potential since everybody was predicting the transistor's cost to go down to minus something, and so therefore the company cannot afford to let this opportunity go, but we're not sure it's true so what do we do? We put out in America the transistor 608. We price it in such a way that we're not going to sell many of them and therefore we have here our first entry in the market where we really can't tell whether it will be good to use our tubes or not. And decide which way we want to go later. I don't think that we can describe IBM as always taking the most advanced technology path without ever looking at costs. On the contrary, I think generally the company is pretty conservative in making decisions of that kind, unless the cost picture is proven to be .....

S. Well when the decision was taken to do away with tube machines, and to go into transistors, these transistors weren't really that far along.

P. No but we had enough basis in my opinion and the future has proven that that was right. There was enough basis for that to be done and if you go back

in history you will find a memo which if I recall properly was signed by Watson, saying from now on all machines have to be implemented with transistors. Is that what you're referring to?

S. Yes.

P. Well I recall very firmly that this memo said unless you apply for permission from me, and it was understood that the deviation was to be granted ..... But the basis for that decision on that memo is the following. If you don't deviate across the board, then the first guy who can use the transistor is going to pay the premium cost and he'll never be able to afford it. If you ..... it across the board then you ... you spread the cost of the whole project and it may be a sound measure.

S. Yes.

..... That's my understanding of the decision and I think it is very well put.

RX S. And did that take effect in the European labs, in the French laboratory also?

P. Yes but this was before the WWAM ..... it had no effect on that part of the program. Okay?

S. Is there anything else that you'd like to say on that particular score on the WWAM and the development of the 1401?

P. It shows one less that I'm not sure we have taken full advantage of. Well I guess we have somewhat in 360. That is that one advantage of the company being multi-national is that being given the same problem, people from different cultures may address that problem with different points of view and putting all these people together generally ends up with a better system than any of them would have come up with independently. While I think we found that in the SPREAD Committee trying to define the 360, I don't think we were doing enough of that ..... Now I'd say one area of the company that's not doing very well is the terminal area. There are people trying to devise terminals all over the place and everybody knows that that we're not quite successful and nobody has a good answer. Maybe that would be an area where ..... experience could be tried again and see if different cultures could bring a better approach. So it's still my most thrilling experience and I think this is the same case for all the people who worked on that program. By the fact that they worked together working on the same project, not what they had done after decision time, but the time they worked together in the same room working on the same final goal with different approaches. And comparing their approaches day to day. The one guy would say, now look there's something new I can do with my

logic and the other guy was trying to see how identically he would be able to do the same thing with his.

S. Well as a last remark on this, can you summarize what you see are the assets of the 1401 which you know directly were inputs by the work on the WWAM?

P. Well as I told you before, I'd rather leave that to the 1401 designers. They can analyze much better what they have done.

S. Well don't do that but I was just wondering how it appeared to you, in a way being less familiar with the WWAM than they are.

P. Well they are much more familiar with the 1401 than I am. I'm not really an expert in the 1401.

S. But the 1401 does have your print-edit.

P. Well it has much more than that. It has the variable word length and that kind of th ng.

S. Well this is what I wanted you to explain.

P. Well I couldn't really summarize it. I've never taken the trouble of going through it from that point of view. I know lots of studies have been made especially by the Patent Department, even if they are just fumbling. They are much better than I would do.

S. You did make the comment before that someone told you that many of the patents generated from the WWAM .....

P. That's the statement that was given to me by the Patent Department which says that as far as the 1401 computer organization is concerned, all the patents covering it are patents derived from the 1401. That's their statement, not mine. ..... The WWAM life ended when the 1401 life started so the WWAM couldn't have taken anything from the 1401.

S. But I did hear you correctly that it's the 1401 patent that covers the WWAM.

P. No, no, the WWAM patents cover the 1401 organization today as far as I'm told from the Patent Department.

S. And this Patent Department is the U. S. Patent Department?

P. No it's the French Patent Department. They're not supposed to give their own opinion. They are supposed to reflect the company's opinion.

S. Right.

P. I assume that there is a patent list covering the 1401 and you just go through them and find out what they are.

S. Okay, well I guess that does it at the present time.

P. Thank you.