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Interviewee: John V. Atanasoff (1903-1995)

Interviewer: Bonnie Kaplan

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KAPLAN:

Today is August 28, 1972. This is Bonnie Kaplan at an interview with Dr. John V. Atanasoff at his home in New Market, Maryland.

ATANASOFF:

The subject of today's recording is to cover the autobiography of J. V. Atanasoff from approximately the summer of 1947 to the present date.

At the last recording we covered the Helgoland blast, and the trip to Europe and this material will not be repeated here. However, I can add a few more details about the Helgoland explosion. In spite of the adverse prognosis by (Burrough Tuve?), all stations except one placed across the continent of Europe, received important and useful data from the Helgoland explosion. In spite of the original restriction of this data to seismic data we had added additional apparatus so that now both seismic and sonic data were obtained, and these were obtained at every station except one. The one exception was caused by an accident to the jeep by one of the jeep drivers who had to be hospitalized at the time of the test.

This data was received with great interest by the scientific community, the Geophysical Union, and by the Navy, and the Geophysical Union got up some kind of a citation for this affair. The United States Navy also transmitted this citation from the Chief of Naval Operation to the Chief of the Bureau of Ordinance down to us who had done the actual work. The analysis of this data took a number of months' hard work by staff after return from the Helgoland explosion, and when it came to publication caused a certain amount of dissension because one of the gentlemen who was in charge of analyzing the data wanted to obtain full credit for the write-up, but I insisted that the file of papers should contain the names of the people who did the actual work as well as those who participated in writing it up. This is a problem which often occurs in larger organizations where duties are divided, but I see no reason why one should give precedence to the actual results of analysis and writing as contrasted to the design of experiments and experimental work.

During the next two years I remained as head of the Acoustics Division of the Research Department of the Naval Ordnance Laboratory, and during this time we were engaged in

additional preparations for instrumenting other atomic explosions which the Navy put on after Crossroads. The Crossroads was the first one of these explosions, but they immediately followed it by successive - the Navy and the Atomic Energy Commission immediately followed this by other tests which occurred out in the far Pacific in different places. Our Division had to supply instrumentation for all of these tests. I did not myself go on location during any of these tests, but my staff participated in a major way.

Another project along the same line was the problem of long-range detection of atomic bombs. I don't remember the exact date that this project was instituted, but it must have been instituted soon after the Helgoland blast, say perhaps in the spring of 1948. And this project was the direct responsibility of the Air Force, and they put Dr. Ellis Johnson, a long-time friend of mine, in charge of this project. These detections were to take place by any means but, of course, it soon became evident that the most important means for long-range detection of atomic bombs would be seismic and sonic. I should perhaps mention that, of course, the pollution of the earth's atmosphere by the atomic explosion was an important approach to the detection of an atomic blast and in this method you had to know the direction of the air currents and have surveillance taking place in various parts of the world. Then if you detected an increase in radioactivity at a given spot you'd assume that there had been an explosion up current from where you were. However, my division was limited to the work on the seismic and sonic parts of these tests, and we received a large budget. Because of its military importance there was great emphasis on this work in those days. Our experience at Crossroads and at Helgoland qualified our organization for this work, and we played a major part in this work until finally the method of detection was regularized and was taken over by the Air Force itself. But by this time I had left the Naval Ordnance Laboratory.

Of course during this period we had a number of routine Acoustics Division activities, and a great deal of our work was connected with underwater sound as before and we continued to make underwater measurements during this period. We had a testing station first at a place called Barcroft Sound west of Washington, and then later after we moved to White Oak we chose a dam site which was northwest of the present laboratory site at White Oak. After we moved to White Oak, not many miles away, there was a dam site called Brighton which we used for acoustic work. This was a larger and deeper body of water than the one we had previously used, and this has been used until the present day. I believe it is still being used by the Naval Ordnance Laboratory as a core calibration site. In instituting these calibration sites and selecting proper instrumentation and perhaps a good deal of instrumentation had to be constructed, these all took a major amount of time. This is a normal activity of the Acoustics Division of the Naval Ordnance Laboratory, and I gave myself to these details of these projects. They're not noteworthy in perhaps any other sense. They have military meaning but --

KAPLAN:

Were you still concerned with --

ATANASOFF:

Of course we were still concerned with mines. We weren't so actively working on the mine mechanisms as the underlying causes of mine actuation, the sonic theory, and things of that kind, building apparatus and standard test gear, and the like.

I will expand somewhat on the work on long-range detection of the atomic bomb during this period. I was studying the reception of sonic signals from a long distance, and I found out that there was a type of background which caused signals of a low frequency kind to enter the receiving system. I decided to attempt to build a system which would eliminate this background. You understand that background means roughly the same thing as noise, and that the question of how to eliminate this noise - when you set up a receiver which must be very delicate for receiving a very low frequency sonic signal from a great distance, and the frequencies will be of the order of 1 cycle per second, one has to examine the background which exists in the site where you're receiving it, and attempt to eliminate this background as well as possible.

I realize the organization of this material here is not too regular, but perhaps it can be extracted from the recording which I am making.

I soon observed that this background was larger when there was a wind blowing than when the air was very quiet. Perhaps a simple explanation is to say that the wind caused the background, but there's more than this to it. It turned out that the turbulence is generated by the wind, and turbulence slowly drifting by the background was the immediate cause - I'm sorry; the turbulence drifting by the receiving point was the immediate cause of the background. The separation of these two effects that due to turbulence and the drifting of turbulence past the receiving point, and that due to the sonic wave transmitted from the origin of the explosion was the problem. In the course of time I devised numerous ways of reducing the effect of turbulence, but the most successful was to build a so-called sonic array. A sonic array is a sonic receiving system which is more or less analogous to that used for receiving radio waves. It consisted of a system of pipes and connections, connecting the system of pipes to the atmosphere. The receiver received the waves generated within the pipe system. The design of the pipe system was to receive the approaching sonic wave and feed it in from the atmosphere into the pipes, and then into the receiving system without allowing any point of entrance to be unduly affected by the turbulence which existed in the atmosphere surrounding the reception array. There was a problem, and this problem was solved by theoretical physical methods. We devised arrays which were more or less directional. Arrays work well if they're not directional. They work still better if they are directional. If you use directional principles as well as other principles, if you know roughly the area from which you are going to receive the explosions, you can do better than you can if you do not know about direction. The whole system of receiving sonic waves received a great impulse forward, directly as a result of our work at the Naval Ordnance Laboratory. You understand the background noise just represents continuous receiving. You can't differentiate in a receiver between this background noise and receiving of a noise of a

lamina signal from some other point in the world. It just gives you a background of such a size, erratic in nature so that it cannot be screened out except by these very special devices which I am describing here.

In the end it turned out that the most effective way of receiving atomic explosions with great distances are seismic methods and here we also used arrays of stations. The beginning work on this use of arrays occurred at the Naval Ordnance Laboratory while I was still directing the program there in Sonics. This was in the period between 1948 and 1949.

In June of 1949 the administration of the Naval Ordnance Laboratory was reorganized and I - I'm sorry, this last part, omit the last part about the reorganization of the Naval Ordnance Laboratory. The reorganization took place all right but it took place at a later date, which I will describe later.

During the Summer of 1949 I resigned from the Naval Ordnance Laboratory and took a position under Public Law 313 at the Army Field Forces in Newport, Virginia – really at Fort Monroe in Virginia. In this position I reported directly to the Commanding General of Army Field Forces and gave scientific advice on a variety of things including armor, small arms, artillery clothing, and so forth. It was an unusual job and a miscellaneous job for assignments to be engaged in. However, I worked at this job for approximately two years, and during this time I was resident on the post. I was a resident on the post at the Army Field Force. Now this job paid more money and as I stated before, it was a Public Law 313 appointment which represented an appointment above the Civil Service level. I had, before I left the Naval Ordnance Laboratory I was, of course, at the top of Civil Service grades, the normal Civil Service grades of the time. And the Armed Forces had by an Act of Congress, Public Law 313, obtained a few appointments at the Naval Ordnance Laboratory, and when they proposed to hire me at the Army Field Forces I told them that I wasn't interested unless they got one of these higher positions. The Commanding General there, General Jacob Devers, proceeded to work his magic and secure one of these Public Law 313 appointments, which was kind of a prize in the Armed Services. And I took the position because of this substantial raise in position and salary. It is obvious that a man is always going after financial gain and power, and this move seemed to be a move forward. I don't know that I obtained my ends in a major way due to this move, but no one knows. You have to take your chances with new organizations, and I did so. And it's true that I stayed at the Army Field Forces in Fort Monroe, Virginia, for only a period of 18 months or a little longer, and then I resigned from Army Field Forces in Fort Monroe. I had tried to regularize the approach of Army Field Forces towards a number of problems which were contained in their program. For instance, I attempted to standardize the method of testing at the various posts for which the Army Field Forces depended for its evaluation of material. This included, for instance, the testing of wheel vehicles and tanks. And I suggested that these reception stations should measure the acceleration compartments of a vehicle by mechanical means instead of depending upon seat-of-the-pants evaluation in terms of the drivers which they used. During this period I had built an accelerometer which I

remember had three wheels, which was used for testing tanks and wheel vehicles. It made a recording of the acceleration during starting and stopping periods of these vehicles. It was self-contained and it could be fastened behind any tank or truck or armored carrier or anything else, and would give a graphic record of the way that the vehicle performed. This 3-wheel vehicle had 2 wheels in line and a third wheel which was contained - which was offset by a normal distance, perhaps 4 feet, transversely to the line of the 2 wheels, and its position longitudinally was about mean distance between the front and rear wheel, which were aligned.

The steering of the vehicle - it was towed by a tow bar and these tow bars steered both the front and the rear wheels which were in line. The third wheel went along for the ride. The tow bar turned the front wheel so that it would turn in the direction that the towing vehicle was going. It turned the back wheel in the opposite direction and the third wheel, which was located laterally, was not turned at all. This provided a good platform to carry the accelerometer which I designed and constructed and place at the center of this arrangement of wheel. The third wheel drove the accelerometer chart and the magnitude of acceleration were recorded on this chart, so we had a distance acceleration chart being generated by the device when it was in use. When I last saw this vehicle it was being used by testing at Ford Bliss, and I imagine this last time I saw it sometime in the year 1950.

In 1951 I returned to the Naval Ordnance Laboratory, receiving again an advanced position, a Public Law 313 appointment, which at this time in order to secure my return the Naval Ordnance Laboratory was able to wrangle. As I look back over these days it is amazing to me that you have to move and do things in order to get ahead. This is the way one man (or woman) climbs over another, and regardless of your merit if you don't adopt such means, progress is slow and difficult. Aggressive and restless men move around and try this and try that in order to get ahead. It's true that from a purely scientific point of view the work at Fort Monroe was not particularly exciting. However, I found many things of interest and I got a very good grasp of the basic operations of the Armed Services of the United States during this period. In order to provide for my integration with the officers of the United States Army, the Commanding General, General Devers, assigned me an artificial rank, and he gave me two and a half stars. So this placed me between the two-star and three-star generals in honors and other things of that kind. A seat was always provided for me between the seats provided for the two-star generals and the seats provided for the three-star generals. These matters of rank were always rigidly maintained in the Armed Services during that day. I believe that since there has been some dulling of this preference.

During this period the Korean War was actively going on and I was interested in belonging to the Armed Services because we were getting continued reports to which I gained access in a ready room. Each morning at ten o'clock we had a briefing -

KAPLAN:

This was while you were still in the Army?

ATANASOFF:

This was while I was still associated with the Army. We had a briefing on how the war in Korea was going and after the Chinese entered the fray actively it was generally going badly. I queried the General as to when we would stop losing - and we were losing and being driven southward. The General said when the troops reached a certain concentration so that there were no unarmed positions, we would bring such terrific slaughter to bear on the enemy troops that the enemy troops would have to stop advancing. I believe that something like this actually happened in South Korea, but this was after our troops had been driven southward over a long period of time, and then we began the slow climb backwards through the Peninsula of Korea.

This is interesting material connected with my stay in Army Field Forces, but in the summer of 1951 I resigned from the Army. By this time there had been a change in the general there, and my stay at the Army Field Forces was not as pleasant as it had previously been, and I decided that my scientific career required that I leave this place which was less interesting and I returned to Washington without a position. I resigned and returned to Washington without a position, but very soon after I returned to Washington I did two or three things temporarily, but then I took a position. By this time the Naval Ordnance Laboratory had wrangled a Public Law 313 appointment and I rejoined the staff of the Naval Ordnance Laboratory as an Assistant to the Director, and I was directly in charge of the entire Navy's Fuse Program.

At this time the administration of the Navy's Fuse Program had been actively in the Bureau of Ordnance, but a decision had been made to put the direction of the program directly in the hands of the Naval Ordnance Laboratory and I was elected as Director of that program. The reorganization and the return of this program, the board Fuse Program of the Navy which spent many million dollars a year - the reorganization and the transfer of this to the Naval Ordnance Laboratory occupied me during the first few months, and after this I commenced to give my attention to the improvement of the Navy fuses. Of course this involved so many people that it was very hard to make much progress. I was a long ways from the actual construction of fuses. I couldn't immediately and by myself change the design of fuses. I had to go around and sell to people who were doing the various programs a theory of the organization of the Fuse Program, and then secure their cooperation. This was a long and arduous program and I worked very hard on it.

Fuses of various types - and these fuses are actuated by many means. We had, of course, contact fuses and time fuses and proximity fuses and many other kinds of fuses in this entire program and to this very day there exist all these different kinds of fuses. The U.S. Navy had been a pioneer in the development of proximity fuses. These are fuses which are put on shells which carry a vacuum tube, a very rugged vacuum tube. They carried vacuum tubes and emitted radio waves, and when these shells came close to the earth or some other object; they exploded due to the proximity of the object. I suppose

proximity fuses represent the most elaborate type of fusing and they are a very expensive type of fusing too. They have always given a great deal of trouble, and sometimes they work and sometimes they don't. The perfection of fuses so they would work more uniformly under a greater variety of conditions occupied my attention during this period.

Perhaps I should state that proximity fuses are of great use in antipersonnel work and for other purposes. In antipersonnel work a shell exploding above the ground, when the shell comes into proximity with the ground is much more effective antipersonnel weapon, a very much more effective antipersonnel weapon than a fuse which permits the shell to bury itself in the ground and then explode. The question of quality control for proximity fuses, also called vacuum tube fuses, was a prominent one and we were examining the results of these tests and attempting to secure a method of adjustment of the fuse that would give a more uniform product. Sometimes in a succession of 20 fuses fired in succession, 16 or 18 of them would premature, due to some extraneous effect which was very hard to ascertain or to improve.

The vacuum tube fuse had been developed during the war in the Russian campaign at the Applied Physics Laboratory in Silver Spring, Maryland. I had not been associated with that development. I inherited the Navy's Fuse Program afterwards. One of the problems with vacuum tube fuses were that they were more erratic when fired over water than when fired over land. This is due to the good reflecting quality of the water surfaces to the electromagnetic radiation, and the fact that sometimes the water will be shaped - the curvature of the surface of the water will be shaped so that it produced a focusing effect of the radiation back on the transmitting fuse, and so produced erratic effects at greater distance. These fuses worked on a kind of radar. It really wasn't a pulse type radar in which a fuse - they emitted pulse and then the pulse returned after time T , in which case the distance of the fuse from the object could be accurately ascertained or controlled. These fuses worked on the principle that there was an oscillating vacuum tube in the fuse and it is continually radiating information, and when the radiation returning from the receptive object to which the fuse is coming into proximity is of sufficient amplitude, it would react and a Doppler would be produced. The Doppler fired the fuse. It, of course, could not distinguish between different objects and so these fuses represent a first order approximation to the problem of proximity fusing. Later fuses were produced that had radars inside of them, but even these did not produce a particularly effective fuse. The whole subject of fusing is a very confused and difficult one. It possessed difficulties of a major type. You have to proceed on a statistical basis to get information and you will only produce results on a statistical basis.

During the two years of my tenure as the Director of the Fuse Program we were pursuing specific efforts to improve the quality of the fuses produced and to measure reliably the statistics of the fuses, to use this as a controlling means to improve the product. This included fuses of all types, and these problems in all fuses were of major type.

Miss Bonnie Kaplan, who is asking the questions here, says, why didn't I go back to a teaching job? This is not perhaps a good time to answer this question, but perhaps no

good time will come in the future, so I will make a few remarks about that subject now.

At the end of the war I intended to return to teaching and was offered the position as Head of the Physics Department at Iowa State College. In the end I felt that life would be more exciting and more interesting if I stayed at the Naval Ordnance Laboratory. Now, I have had various opportunities to return to teaching since that time, and on each occasion I felt that I would make major sacrifices either in money or in an interesting career if I returned to teaching. However, a careful contemplation of life indicates to me that I would have been very happy if I had returned to teaching. I have been happy wherever I am, and so I do not think that any one course is necessary in order for me to accomplish a life.

When I went back to the Naval Ordnance Laboratory, of course, by this time the Acoustics Division was in other hands and I was offered this very high position, this Public Law 313 appointment which was, as I stated before, the first Government steps towards creating positions which were above the standard hierarchy of the Civil Service system. And this was a much better position than going back as Director of the Acoustics Division, although I must say that as far as I'm concerned I've spent a great deal of time in administration and organization, but my happiest days have been when I was in close proximity to mature things and engaged in experimentation and science with my own hands and with my own mind.

Why does a man do a thing like this? Why does he leave the things that he likes best and go into executive work? Well, I'm not quite sure. This is the question that Bonnie's asking now. You can see that she's running a constant stream of questions at me. I don't know why a man does a thing like this. I'll think about it and if I come to a very wise answer I'll tell you before the end of this description.

Miss Bonnie Kaplan is asking about names and I'm supposed to engage in some kind of a name-calling contest here. I suppose the names which I can give at the Army Field Forces or at the Naval Ordnance Laboratory in connection with the Navy's Fuse Program will not be the names of people who are very famous, nationally speaking. Of course at the Army Field Forces my contact was first with General Jacob Devers, D-E-V-E-R-S, and later a man who is much better known, General Mark Clark, the man who waded ashore in Africa with three million dollars in his jacket.

General Clark had waded ashore in Africa at the African invasion with a large sum of money in his hands, several million dollars I believe, and then later he fought through Africa. Then he was engaged in the invasion of Italy during World War II, and his name is famous or infamous depending on your point of view, in connection with the Repeto River incident. Many American lives were lost at the crossing of the Rapido or Repeto River in Italy. I have had reports from various sources. I would never have thought of raising this question with General Mark Clark, but on one occasion when I was taking an airplane trip with him, something happened that triggered him about the Rapido or Repeto River events and he engaged in a most fervent and heartrending discussion

explaining his point of view in this affair. On the other hand, I had an input from a friend of mine whose brother was a lieutenant in command of troops at the Repeto River and he took one look across and refused to order his troops to advance in that area and was relieved of his command. It was one of the nastiest events in World War II in which American lives were sacrificed, and it is reported that General Mark Clark was always afraid to return to Texas because so many men from Texas in one division were lost during this event.

I do not know if there is a good history of the Naval Ordnance Laboratory in which the reorganization of the Fuse Program is recorded. I do not believe there is. It's too bad that Government laboratories don't keep a running history of all events as they pass because considering the amount of money that's spent it would be useful to recall what actually happened at the time in question. This would help to justify the expenditure of funds. Maybe this is the reason it is not usually done.

During the spring of 1952 there was a major reorganization of the Naval Ordnance Laboratory, and I found it necessary to again assess my position and progress in the scientific field. Perhaps it seemed to me at that juncture that the work in the future at the Naval Ordnance Laboratory would prove to be less interesting than it had in the past, and question turned into decision. I decided to leave the employ of a Government laboratory, to start a corporation in which I was a stockholder, perhaps even the principle stockholder, and to engage in an independent organization as an entrepreneur as well as an administrator and a scientist.

As a result of this I formed the Ordnance Engineering Corporation of Rockville, Maryland. I believe the articles of incorporation of Ordnance Engineering Corporation were dated at the end of January 1952. We rented quarters at Rockville, Maryland, in March 1952, and by this time we had secured a contract with the Bureau of Ordnance. This was a Maryland corporation. By March or April we had secured a contract with the Bureau of Ordnance for certain activities in connection with promixity fuses, to measure and improve the quality. This was a large production at the Bureau of Ordnance, and this was our first contract. I believe the first contract that we secured was for a sum of about \$300,000 or \$350,000.

I knew very well that this company would do what it could find to do and I'm a flexible man. It would do scientific investigations and testing for anybody and in particular for the Armed Services, because the Armed Services were the sources of much contractual possibilities of that day.

When the corporation was formed it turned out that I bought much of the capital, initial capital. Perhaps two-thirds of it was supplied by me and one-third of it supplied by a number of my friends who immediately came to join me in this activity. Among these I should mention, Mr. David Beecher, Mr. Frank Cramer, Mr. Ernest Colfield, Mr. Lynn Hanon. Because of past history it was an easy thing for me to secure the services of men, and early competition at this time consisted in getting a staff together, because if you had

the staff to do a job you could probably get the job. This was not true before nor has it been true since that time. The fact that I could secure the help of able men meant that I could be a success in business.

We engaged in anything we could get to do for the Armed Services, and we were not as favorably placed as many other concerns. Nevertheless, we secured a great deal of work and were reasonably successful. We engaged in research which is associated with the exact science. We wouldn't do biological research. As a matter of fact we would have no opportunity to do biological research. None was being offered; none was being done in that day.

KAPLAN:

What specific areas--

ATANASOFF:

I'm going to recount the - Bonnie's asking what specific areas. Well, to begin with, during the first part I worked with some fuses. Now I'll just enumerate the projects which we did in the Ordnance Engineering Corporation. Without further study I can't give exact dates that I did this and that and other things, but one of the projects on which we put a great deal of time and spent a good deal of the Government's money was in a proximity scoring system. The idea was to have some measure of determining the proximity at which a guided missile or a fuse approached an aircraft when the aircraft is climbing the sky. That's part of the basis for evaluating antiaircraft fuses and control systems. Control systems that had previously been devised. In support of this we invented a device called a fire track which operated by interference principles. This fire track was one of many systems devised to perform these functions. A moving target carried a number of antennas, and by examining the interference pattern of the signals received at these various past the moving airplanes. The motion of the projectile in a (coordinate?) system carried by the airplane in effect. In this way not only could the proximity of approach of the missile to the airplane be determined, but also the angular orientation of the encounter. It should be realized that this device was for testing purposes only, scoring fuses against our own airplanes or against our own drone airplanes. So it was possible having the airplane carrying the antennas. It was for testing purposes only. It was not an actual military device. This project was carried out by the Bureau of Aeronautics of the Navy, and this work was done under several contracts, and the total of these contracts must have totaled a half a million dollars or more.

To evaluate this device it was necessary for us to fly missions at an air base where missiles and target were available. This work was done at Point Mugu, in California, and Dr. Ronald Weller(?) was Chief Scientist at Point Mugu while these were going on. There were many waits and delays while the tests were organized, but in the end the tests were fairly successful and the Navy bought the device and we constructed a number of these devices for the use of the Navy. Our firm did all of the actual construction on these

devices.

You must understand that at this period of our activities we had between 60 and 100 people of various kinds employed at the Ordnance Engineering Corporation. The space which we had rented at Rockville was a building owned then by Maloney Concrete Company of Washington, D.C. It soon became too small and we commenced looking around for different spaces.

[End of Side One]

The results of this investigation led us to Frederick, Maryland, and more specifically the airport at Frederick, Maryland, because we were doing testing with airplanes on various devices which we were concerned with. We purchased a piece of land at Fredrick, Maryland, and commenced construction of a building there, and this building still stands at the airport in Frederick, Maryland and forms part of an aggregate which is now owned by Aerojet General out in California.

Another project I should mention that the Ordnance Engineering Corporation did was a study of the use of sonic noise in battle for surveillance purposes, and here our previous experience in long-range reception of atomic bomb commenced to play a role; although frequencies are much higher it was necessary to employ some of the same techniques. And we found that we could easily detect the noise emitted by an internal combustion engine at a distance of a mile or so, providing care was taken to exclude the normal background.

Another project which I remember that the Ordnance Engineering Corporation worked on during this era was the meaning of antipersonnel leaflets. The United States was in Korea and they were using psychological warfare in attempting to get the enemy to defect. The precise approach physically to the spreading of leaflets was the subject of a study which the Ordnance Engineering Corporation did for Operational Research Office. Operational Research Office was an Army organization which was located in Washington, D.C. The head of this organization was Dr. Ellis Johnson. In order to effect this purpose we sent members of our staff to Korea and they flew front line missions to understand the proper location of leaflets to secure the greatest imprint on the enemy, depending on the attitude which enemy officers took in regard to the picking up of leaflets.

I would like to recapitulate and summarize my activity during this period with the Ordnance Engineering Corporation. This engaging as an entrepreneur as well as a private scientist or an administrator intrigued me. When I started the Ordnance Engineering Corporation I decided there were gross lacunae in my background. I started zeroing in on one or two of the principal of these.

In the first place I knew absolutely nothing about accounting, so I decided I would learn to understand accounting principles in detail so I could read financial reports and understand them quickly. This I accomplished in a period of 3 days by giving my sharp

attention to the whole subject. I could have done it in a single day if I had a book of the proper character, but the books which I secured on accounting were more or less the standard books, which I had to read through, for the inner essence of the subject, read through the nomenclature recorded thereof. And as I look back on the whole subject I realize that during this period of 3 days I really got a very good grasp of the whole subject of accounting. To this very day I can make criticisms in accounting methods and can read financial reports with great accuracy and ease. My acumen in regard to accounting became so good during these 3 days of active study and active applications of accounting principles to the Ordnance Engineering Corporation that I once got into an argument with the certified public accountant who was engaged in verifying our books for some purpose or another. He was a member of the staff of Price Waterhouse and I said, "I'll bet you that you're wrong." He said, "How much?" and I said, "A dollar." He said, "How will we find out whether we're right or wrong?" I said, "Well, you go and ask your boss and then come back and pay me the dollar." Whereupon he did and I insisted he sign the dollar and for many years I carried the dollar as a mark of my accomplishment in the field of accounting.

As I look back on the whole event, of course, I realize that I had a peculiar advantage because of my grasp of mathematics and logic systems which was very complete at this time, and a mathematician and particularly a theoretical physicist has a grasp of many things - a potential grasp of many things if he's just tipped off in the right direction. I have a feeling that accounting is a very important element of business procedures.

Another thing I felt that I sorely lacked in approaching the subject of a personal business was the field of corporation law. I had to form a corporation for the purposes of carrying on the activities of the Ordnance Engineering Corporation, and the actual incorporation required that I study corporation law. I spent a month on this topic, a much harder topic for me to encompass than accounting. I did get a very good grasp of corporation law. I completed enough so that I could file corporation papers and amendments to the corporation papers. In other words, I could handle corporate papers as well as work in any of the principles that were incorporated. I, at the present time, have filed three or four sets of corporation papers with the Maryland Corporation Organization, each of which I have written myself personally.

Again I say that I was happiest, even when administering or acting as entrepreneur, and acting as director for the Ordnance Engineering Corporation, I was happiest when I could go down to a lower level and work on the projects myself. As a matter of fact I could walk through the laboratories, I kept in such close touch with the work of my men that I could walk through the laboratories and tell from what each man had on his desk what phase of the topic he was working in.

I think it is true that my ideas furnished a considerable part of the core on which the Corporation worked. It is not bad for a corporation executive to have this grasp of scientific matters, but it is also necessary for a corporation executive to tear himself loose from these close contacts with science, look into business affairs, read the financial

returns of the organization to which he's attached and other like organizations and attempt to understand them and recognize which approach will permit one to make money, and to do many other things.

One of the principal other things is the matter of personal relations, and I have never - I have had trouble with personal relations, not an inordinate amount because I have a great deal of affection for the men who are associated with me and we generally understood each other pretty well, but nevertheless they regarded me as kind of a harsh director, always attempting to advance the work at all times of the day and night. And some of them grew restive under this discipline which was necessary to hold the organization, to offer any chance of success.

How does a man do things like this? Well, I suppose the answer is money and power. And approval of his associates is a kind of power perhaps and a kind of payment, however, for the difficulties of such operations. It is a fairly hard life, and I have no regrets that I engaged in these operations. However, it is true that I found this discipline severe.

Well, as I stated before, we found a piece of land at Frederick, Maryland, and built a building thereon and moved up to Frederick. We hadn't been there more than about a year when I was approached by a variety of people who wished to purchase our organization. This was the style at the time. Large organizations were attempting to pick up smaller organizations in order to grow, and because it meant an easy way of acquiring more activity. And we were approached by 4 or 5 organizations with some degree of seriousness during this period. Three of the corporations which approached Ordnance Engineering Corporation as prospective purchasers were Hoffman Electronics of California, Taylor Instrument Company of Rochester, New York, and Aerojet General Corporation of California - really of Ohio. Their original corporation is in Ohio. Aerojet General is incorporated in Ohio, but their principal places of business are two places in California.

I remember that I greatly irritated Mr. Hoffman when I told him I was not much interested in TV. He felt as if TV was an activity which presaged the greatest improvement in the human race, and I told him that I thought it would produce an awful lot of transmissions of poor quality. He had been active in the production of TVs in the California area. His TVs were not well known in the East, but he produced many which had been sold in the Western part of the United States. He felt greatly moved by this activity and he felt that he was a benefactor of mankind because the finest performances in the world could be brought into the homes of every man in the United States. I felt that the outcome would not greatly benefit society, and that these would be used for commercial purposes and in the end, I believe, that my side of the argument represents a fair statement of what has happened in TV, not that there have not been many great benefits.

I had a very pleasant association with Taylor Instrument Company of Rochester, and the

officers of this company were very kind of us and they made a very generous offer to purchase out organization, an offer that at the moment it seemed that we would accept. The "we" given here refers to me and the staff of the Ordnance Engineering Corporation.

The lady who is questioning me asked why we were interested in selling. Well, J.V. Atanasoff had engaged in a private business during this period of time, 1952 to 1957, a period of 5 years, and we had made some progress. We looked like a going organization. And we knew that there was going to be a change in times and that contracting business would get more difficult, and in particular my own prejudices were that we were approaching a Republican administration. Yes, Eisenhower was elected in '56? I mean Eisenhower was elected in '52 and was re-elected in '56. Are you sure of this, Bonnie? Bonnie says yes. And I felt that the pressure of the Republican administration would be to tighten and put in the hands of large corporations more activity of the Federal Government, and so the competition of a small organization such as mine would become more and more difficult. Bonnie says I started the organization in '52 when he was elected. That is true, but we had a pattern of things that had gone on previous to '52 which carried over into this era and we operated under it. But there was continued pressure to shorten the number of small contracts - to decrease the number of small contracts that were let, and this pressure went on during the first 4 years of Eisenhower's administration. And I felt that if he were re-elected this would continue. Of course we were getting further and further from the war years, and I felt that emphasis on the matters where we were trained and experienced in getting contracts would decrease, and so I felt that it would be a good thing to get out. It turns out the decision to sell the Ordnance Engineering Corporation took place in the latter part of 1956.

In the end the offer of the Aerojet Corporation proved to be so remunerative and attractive - remunerative as far as payment for our company went and attractive as far as future activities went that my staff and I, more precisely my stockholders and I, decided to sell to Aerojet General of California. This decision proved to be fortuitous. When I was negotiating for the sale of the organization to Aerojet General they decided that we could have half of our payment in money and we would have to take the other half of our payment in stock of Aerojet General. I asked Mr. Dan (Kendrick?), then President of Aerojet General, how much his stock was worth and he said, "J.V., I think it's worth a hundred, a hundred dollars a share." We took half of the payment in Aerojet General stock at ninety dollars a share and I took it into my private portfolio, estimating its value for that purpose at fifty-six dollars a share. At that moment it did not have an exact market value. It was sold over the counter and had an uncertain market value. In the end Aerojet General stock was divided tenfold and each small portion resulting there from increased in value till it was worth sixty to eighty dollars. So the part of the payment which we received in stock became much the greater portion of the payment which we received. As a result of the market conditions of the times, the effect of the stock was increased six to tenfold in value.

I was not able to foresee these things at the time I sold to Aerojet General. I thought I would come out fairly well as a result of this sale, but as matter of fact the market

conditions of the stock were so favorable to those like the organizations which were connected with the military effort that this looked like a very valuable stock, and it soared to heights which are unbelievable. Today Aerojet General stock is worth somewhere between \$20 and \$25 a share. It's exactly the same shares that we sold at the time for between \$60 and \$100 a share.

All of this goes to show that the way of an entrepreneur is difficult and uncertain. I do not believe that any entrepreneur is able in specific instances to foresee the results of acts which he takes, although he may pick a variety of acts which rise on the average and this may result in an increase in the value of the material things which he holds.

The first Ordnance Engineering Corporation was held as a subsidiary of Aerojet General. Later it was incorporated in Aerojet General as a division. I named this division the Atlantic Division of Aerojet General. It was an independent division operating in Frederick, Maryland, under my direction.

About this time I foresaw that there would be a decline in military activity, and I was looking for a commercial outlet for our efforts, and I selected the field of automation and automatic product handling as an appropriate area in which to work. Well, I tried to get contracts in this field and these contracts were not easy to come by because at that period not many minds were turning yet in the direction of automation. This is during, let's say, the calendar year 1958. I was attempting to do consulting for the Post Office and to build automatic devices for handling the mails. This included automatic sorting and handling devices.

We built a system for mechanical handling of packages in which we used moving belts and a memory. At the beginning of the belt an operator read the address and he had under his command a hundred or three hundred different divisions. He operated a key as articles were placed on the belts, and when the belt came to the proper position, the given package in this case was diverted into the proper receptacle which corresponded to the address of the box in question. Very soon after this we commenced to reach for automation work. It is true that a great deal of effort was put into this, and contracts came slowly. This was during the period between 1958 and 1961.

In 1961 the demand for automation in material handling got larger and larger, and it became evident that we would succeed in the field. The people who were assisting in this project were the same people who had been with me from the beginning in Ordnance Engineering in the main, but many other people had meanwhile joined my staff. And some of these were able contributors to our total effort. We were making plans for an automatic warehouse for some of the large St. Louis shoe manufacturers during this period. Of course we continued with war connected research, and this provided a backlog of activity during the period when the work in automation was slow, but we were making a determined effort to leave the field of war connected research and move in the general direction of commercial activity, into automation. Automation was in its infancy, and we had many basic discussions with those in the fields.

I remember a discussion with the Post Office in which the Post Office told me they were preparing to assign projects for the automatic reading of addresses on parcels and the mails. I suggested that they go no further in this direction, but that they get themselves a good zip code. I use the words "zip code" with reservations because I didn't use the words myself at that time. The words "zip code" had not been invented, but I suggested they put a number on a package according to its destination. In particular I said, "If you put the number to base 2 on the package then it will make reading much easier, and the zip code in effect can be read by machinery at a later point in the travels of the package." They told me that the use of a zip code would be illegal and that it would never be accomplished. This illustrated the pressures of the times can gradually modify the strongest patterns of society and turn society around, so that they will accept devices which they would not at first accept.

The project involved in reading the material which is on the cover of a package or envelope had advanced, and many millions of dollars have been spent on these researches. It is not fair to say that they have become a practical success from the point of view of the Post Office because of the very many varied types of handwriting and printing which occurs on the outside of a package. It's clear that if the material is written and constructed by hand it will never have an exact enough structure to permit its resolution in terms of a machine. Perhaps never is the wrong word; perhaps for a long time this will not be accomplished. Many people have attempted to employ many algorithms for analyzing what the meaning of an address is on a package, depending upon the shapes of the letters and this and that and whatever, but these devices have all come to the same end, that the variability of the way that we have addresses is one which is easily resolved in the human mind (within limits of course), but that is very difficult to mechanize. I did not work on this project of mechanical reading. I perhaps could have if I had sympathized with this project but I felt as if this project would spend a lot of money and not succeed very well. I believe that my assessment of this situation was correct.

I remember during this period that we were doing various war connected researches, such as we did a project on anoxia for the Bureau of Aeronautics of the Navy. Anoxia means - this is a device which would continually indicate the percentage of oxygen in the breathing air of an aviator, the partial pressure of oxygen in the breathing air of an aviator so that he would have a warning if this partial pressure became too low for his effective work. We worked on two or three different methods for estimating the amount of oxygen in this air, and one of them was to move a jet of the gas which the aviator was breathing past a magnet, in which case the jet would be diverted according to the percentage of oxygen which the jet contained. This is due to the diamagnetic character of oxygen.

I remember that we were completing fire track during this period, and we were building little transmitters to go in missiles to be associated with the fire track proximity scoring device.

The work on pulse restoring took on a different character, a character of a war connected

research consisted of a lot of little separate projects, but when we reached automation it was necessary for us to perfect a limited number of rather good devices and try to sell them on a large scale. This was the only way that progress could be made. You couldn't sell a new idea too easily to a businessman. You had to have something in which you had experience, in which you had previous experience, and our diverter -- the device that I described before for diverted packages from a moving belt -- proved to be such a device, and it formed the core of many different systems which we proposed, in these earliest days, to the Railway Express Agency (REA) and to trucking firms throughout the United States and to the Post Office itself, of course, where they are handling packages. So our history at this time was that of making successive proposals to these organizations on a specific basis in which we had more experience. Even with this concentration of effort we clearly lacked experience, as everyone in the field did at that time, and we were trying very hard to make real and substantial progress.

I remember that we were developing a letter sorting device which consisted of a large rotating system perhaps 20 feet in diameter, rotating about a vertical axis, and carrying a series of clips which retained a letter on the outside by means of a vacuum system. When the letter reached the proper address it automatically moved into a chute at that place. For a time it looked as if this would be a very successful machine for sorting the mails, but its principal defect was its large size, which would have made it hard to use under practical conditions.

We were making specific proposals to a large number of organizations and we, during this time, made a major proposal for a Post Office. We made a proposal for a very large Post Office in the New England region. I want to follow this with some remarks about what happened. We made this proposal to an Assistant Postmaster General, and in order to improve the chances of us securing this contract, officers of Aerojet General from California were there to assist in the presentation. When we were through with the project it was clear that we made a favorable impression, but in the end we lost the contract to another firm. And recently this Post Office has proven to be a substantial miscalculation.

After we sold Ordnance Engineering Corporation to Aerojet General we -- I was just merely the manager of the local division of this company. I should say after our reorganization we were a division of Aerojet General. I was just the manager of this local division. Then in 1959 I was made a Vice-President of Aerojet General. This was to give the local organization more prestige so that we could sell our efforts more advantageously in the commercial field, or at least this is one of the factors which contributed to this elevation of my position.

I should have perhaps mentioned that when I transferred to my own business in the Ordnance Engineering Corporation, and later when I worked for Aerojet General of California, I had passed into another phase of my experience - namely, I was principally a salesman. I suppose all administrative duties carry some elements of salesmanship with them, but I was left in a very exposed position where I had substantially no help with

sales effort from the rest of the company and I had to furnish the motor power for a continuous aggressive sales campaign, or it would mean the failure of efforts of the organizations to which I was connected. Bonnie asked why they didn't support me. Well, it wasn't any ill-will that they bore me. They were just busy reporting their own activities and they didn't want to be bothered with mine. Oh, I was part of a company, but then they had a master sales organization, but the master sales organization didn't get around doing much of anything for me. They warned me that this would be true, and as a matter of fact their warning was fully effective. I maintained a sales staff of my own, but in the end I had to sell my own activities to a considerable extent, and these efforts on my part on the whole must have succeeded for the organization would not have stayed in existence. This is a horrible metamorphosis in the history of John V. Atanasoff.

What men will do in order to succeed is amazing but - why, does a man go through such a history of activity as I have? You just get into the organization and you're got to go and you clearly see what is necessary to make it go. Most often if you're in business this is salesmanship and you engage in salesmanship, and you get to be a little like other salesman. You're not quite so cautious in speaking, you speak with more confidence and in a more strident tone, and you find yourself a different person with a different outlook than you are when you're acting as a pure scientist. I continued to miss science and working with mathematics and working with my hands in experimental work. Occasionally I would sneak into the shop and make something with a lathe just to keep my hand in.

The sales effort was particularly slow in the field of automation. This is true, as I stated before, because the world had not come to fully appreciating the possibilities of automation, and businessmen are naturally conservative in a decision to modify their processes. This field of automation has, however, succeeded overwhelmingly, so it was the right decision for Aerojet General at that time, and as a matter of fact, it's still the right decision for Aerojet General. This division of Aerojet General represents, I believe, the greatest commercial success of the entire organization of Aerojet General.

When I look back on this period I realize that our division was moving ahead as fast as any other organization in the United States in these fields, but in view of the slow success with sales I was placed under considerable pressure by the officers of Aerojet General. I felt very obligated to Aerojet General because, by this time, due to the gyrations of the market and the conditions under which we sold out to Aerojet, I had made a lot of money. Perhaps I tended to express this, my feelings about this, by sticking by and being very faithful to the Aerojet General, and in general, my efforts were rewarded and my relations with the administration were satisfactory.

At this time we were negotiating for a large contract for automated handling of shoes, and the officers of the company were present. For some reason I did not engage in enough obsequious, as far as these officers were concerned, and they complained a bit to me. I suppose I was under considerable pressure at the time because this contract was a thing in which I had put a large portion of my personal efforts and I didn't much care whether the

obsequities were right or not. Correction: I was not too interested in being obsequious. I had too many more serious questions to face. I had developed a certain personal relationship with the officers of the shoe company, and it was necessary that I maintain these relations in order to succeed in getting the contract. This irritated some of the officers -- one of the officers of Aerojet General -- who had come East for the purposes of the discussion; although I introduced him and made every effort to place him in the proper light, he felt as if I took too much on myself in stating the terms which I decided in the contract. He complained and I told him to jump. Thus I had met another turning place in my life.

As I look back over the various turning points which have led to the role which I played in the labors of the world, I believe that this is the way it must be and that decisions must frequently be made on a quick basis, but they should be under laid with a lot of experience and hard work, particularly a lot of hard work, and to attempt to live under any other circumstances is to waste your time. Since this has happened I have never been sorry for a moment that I decided to resign from the Aerojet General Company of California. And I am very happy today with that decision. As the Vice-President of Aerojet I had to engage in many high level activities with that organization, and many of the men with whom I was associated were extremely fine and able administrators and I enjoyed these periods. However, the business standards of the time were such that these incidents became highly alcoholic and I found that I was drinking too much and getting too fat and flabby.

At the time of my resignation I was 58 years old and this is rather early to retire. However, I had retirement in mind and, at any rate, I had in mind to escape from the treadmill on which I was engaged at that moment. Especially I did not want to spend the rest of my life selling and it looked as if the principal effort of the Vice-President of Aerojet General was to sell. Perhaps I would have been happier in an organization where the selling would have been done by others and in which I could have devoted my time and attention to administration and to science. Such a possibility was available within the Aerojet General organization. I was offered an opportunity to go to Aerojet to become head of the Aerospace Division of that organization. Somebody had conceived that we're entering the space age and Aerojet General should play a role, and that I would be the man to head that organization. This was before I resigned that I was offered this position. I had to make a quick decision (I was at the dinner table) about this, because an officer of the company got up and offered during a dinner, suggested that I be given the position. I got up and made a very polite speech, speaking about the greatness of Aerojet General, but saying that they were dealing with a man of peculiarly limited sight and that I thought that the great adventure of mankind was not in space, but in the mind.

Meaning exactly what? Well, I think that the mind and its activities present the most interesting aspect of life. Of course this includes almost everything, and perhaps it even includes space, but I didn't want to concentrate on space. I would be even more interested in work on space if it was space of a geometrical or scientific nature rather than space of astronauts and propellant systems. I believe that science is the essence of the

product of the human mind.

Here I was, having resigned from Aerojet General, I had been in rented quarters in Frederick, Maryland. And in 1959 I purchased a farm 10 miles east of Frederick on the highway to Baltimore, and I had purchased two additional portions of land to make this location more advantageous. I thought of moving, but I thought I would stay in Frederick and build a house on this farm, and in the end I followed the latter course. I had been interested in various aspects of home construction and at this moment I secured an architect and we designed a house to be constructed according to the ... method of pouring concrete. This, of course, is not a well-established commercial approach to the construction of houses and so it was necessary for me to put a lot of time and effort in the construction of this house. This house occupied my attention for perhaps two years. I devised new and original approaches to many aspects of house building which were necessary for this construction.

During this period I became a consultant. I did one other thing -- I became a consultant to the Stewart Warner Corporation who were interested in entering the field of automation; for a variety of reasons this effort was aborted. I believe to this day that Stewart Warner Corporation is not in the field of automation in any substantial degree.

Also during this period, in 1962, I formed a corporation called Cybernetics Incorporated for which I wrote the legal paper. It is a corporation under the laws of the State of Maryland, and joining me in this corporation was a man who had formerly worked for me, named Robert Gathers. Under this organization we did a certain amount of work in the field of automation, and in particular we undertook the contract with Stewart Warner Corporation under which -- which I referred to above. Mr. Gathers left Cybernetics and went out to Denver, Colorado, and entered the computing field with emphasis on software.

During the subsequent years I have turned my attention to basic thinking about a variety of subjects, and these will be discussed in what follows.

[End of Interview]