

Question 88: Atomic Bomb: Sen. Wolcott Remarks....German Progress....Raising the Money....Roosevelt.... Groves & Oppenheimer.

There's enough on this Question Number 88 to occupy a whole reel. I'll start with a Senator Wolcott story.

Fred Wolcott was one of my trustees at the Carnegie Institution. Sometime after Alamogordo he got hold of me and said, "Van, what were you thinking of out at Alamogordo just before the bomb went off?" "Well," I said, "Fred, I was thinking this: [X-REF BACK TO P. 128] that if the physicists had calculated things a bit wrong and the bomb was many times more powerful than they expected, you'd need a new president for the Carnegie Institution of Washington." And he said, "Yes, yes I know, but what else were you thinking about?" "Well," I said, "I was also thinking that if the damn thing didn't go off, you'd need a new president for the Carnegie Institution of Washington."

Fred Wolcott was a very fine individual. He was not the most brilliant man in the world, but he was one of the most likable. He very much wanted to do something during the war that would be helpful, but he was a bit old for that, and he was not, of course, really a technical man. But some of the chaps [EH to VB: WHOSE CHAPS?] [VB to EH: MINE--OSRD] were developing mosquito repellents. Incidentally, these mosquito repellents have been very popular since the war. So I got Fred in touch with them to help them test them. He went

- 1) WWII
- 2) THE A-BOMB & THE BUSH STORY ABOUT "NEEDING A NEW PRESIDENT FOR CIW"
- 3) SENATOR WOLCOTT

all the way up to Alaska, where there are plenty of mosquitoes, and tried the repellents under all sorts of circumstances. He was delighted! When the poor old fellow was about through, and near his end, one of the things he was proudest of, according to his son-in-law, who was with him, was that he had had a part in the war. A small part, but nevertheless one in which he took pride.

I used to go fishing with Fred Wolcott at his place up in Connecticut. [EH to VB: WHERE?] I fished there with Herbert Hoover [X-REF AHEAD TO P. 716] and I saw a good deal of Fred in one way or another. He was a great fellow for hunting and fishing and he knew the woods well. I remember going down to an old shed with him one day; he said, "There's a bird that nests here every year; I wonder if she's still here." He reached his hand up over a beam and found the bird on the nest, felt under her and said, "Yes, she's here, and she's got some eggs."

* * *

Now we jump a very long distance to the time that I went overseas in connection with the proximity fuze. And that part of the story will get told elsewhere, do doubt. [X-REF BACK TO PP. 168-169, 193 AND FORWARD TO P. 445]

In connection with this, I went down to Versailles and I saw Bedell Smith who was Eisenhower's Chief of Staff and took up the proximity fuze affair with him. When I was about to

- 1) WWII
- 2) SENATOR WOLCOTT
- 3) BEDELL SMITH INQUIRY ABOUT BERMAN A-BOMB

leave, General Waldron, who was with me, went out of the room. [Pete Cox says I went in alone.] Smith stopped me and said, "There's a thing I want to ask you about." When we were alone he said, "I want to know where the Germans stand on their development of the A-bomb." [X-REF BACK TO P. 169 AND AHEAD TO P. 446] I said, "Well, Bedell, will it be all right if I tell you in a week?" And he said, "Sure."

In that week I went up to the front in connection with the proximity fuze. I also sat down that very evening with Goudsmit. Sam Goudsmit headed the team, made up of scientific fellows, that worked with the team from Army Intelligence who were attempting to find out just where the Germans stood. They had found out a great deal, but they were not sure. We had the old evidence of the Norway heavy water business [X-REF BACK TO P. 120] which made us think the Germans might be ahead of us. In spite of the fact that we were getting evidence that they were not, we still were quite a bit in doubt. Goudsmit said to me, "In a few days I can tell you much better."

Just about that time Strasbourg fell. While I was away, Goudsmit and his team went down there and as usual the Germans had pulled out all their scientific people and their files and so forth. But this time they'd made an error and they left behind a stenographer who was highly anti-Nazi. I believe some of her relatives had been exterminated in gas chambers. I think she was Jewish, as was Goudsmit. [REP., X-REF BACK TO P. 169] She had saved her old stenographic notebooks, and

- 1) WWII
- 2) GOUDSMIT
- 3) REPEAT OF STORY OF GERMAN STENOGRAPHER & A-BOMB INFORMATION

the team sat down and went over them with her. She'd start to read a letter and they'd say, "Never mind that one." Then she'd start another one and they'd say, "Oh, oh, type that one out." Before they got through, they knew the entire story very well: that correspondence showed it. Of course, Goudsmit's team was a group that really knew the German scientists. Some of them had studied with them or under them so that they knew who was writing to whom.

- 1) WWII
- 2) REPEAT OF GERMAN STENOGRAPHER STORY
- 3) SAM GOUDSMIT -- HIS BOOK "ALSOS"

When I next saw Bedell Smith, after I got back to Versailles, he sat down with me and he outlined the timetable for the balance of the campaign. He included, incidentally, a German counter-attack, not where it was going to occur, but they were expecting a German counterattack. [REP. X-REF BACK TO P. 170] Then he said, "Now, we could shorten this timetable but if we did, we'd do it at the expense of considerable casualties. On the other hand, there's no real reason for lengthening it much more than this. Is there anything in the German progress which ought to cause us to shorten it?" And I could tell him, then, "You can take another year or two if you like and the Germans will have no A-bomb." I could be perfectly sure of what I was saying.

Goudsmit's book is called Alsos, which is Greek for "groves." It's an excellent book. I think I have a copy still, but at any rate, you ought to look it over, it's quite a story. [EH HAS, 4/65]

Goudsmit was a good man to do it because in his case also, some of his family, and I think his elderly parents, had been killed by the Nazis. He discovered this when he got into Haarlem and got at some records. Needless to say, his group got a little rough after that.

The story of when they went into Heidelberg is excellent. 1) WWII
I think that Goudsmit tells it. [EH NOTE: RESEARCH] When 2) UNIV. OF HEIDELBERG
they went in they were supposed to go in anywhere with the GAINING INFORMATION
second or the third wave. Actually his men went into Heidelberg 3) ATTITUDE OF GERMAN
riding on top of the tanks. The scientists at Heidelberg were SCIENTISTS TO AMERICAN
all promptly seized and confined to their quarters and Goudsmit's A-BOMB DEVELOPMENT
men went around and talked to them, one after another. Of
course they knew them and they'd tell one fellow what the
other fellows had told them or what they conceived that they
might have told them and they gradually opened them up until
they got pretty much the full story. [EH to VB: AN AWFUL LOT
OF PRONOUN TROUBLE IN THIS SENTENCE.] [VB to EH: SO WHAT?]

There were light times, too. When they got into the
University of Heidelberg, they found some diplomas already
signed by the chancellor but with the names not yet filled
in -- diplomas for Doctor of Philosophy. They proceeded to
hold a convocation, called in some of their Army friends and
proceeded to confer on them the degree of Doctor of Philosophy,
and gave them a genuine diploma from the University of Heidel-
berg made out in their names and duly signed by the chancellor.
These must be mementos of some cherished value although I've
never known who the officers were that received them.

The scientists were taken to England and there interned.
In their camp, they wondered why they were not being used.
They thought of course, they had been taken across to England
to help the Americans with the A-bomb development. When they
were not used they couldn't understand it, because, of course,

they thought they were the great scientists in the world and the Americans couldn't possibly do without them.

They were not used and they were told nothing. When the bomb went off, and they got news of it, they could not, for a long time, believe it. When they finally had to, they contended that the Americans had dropped a whole atomic pile instead of a bomb.

Well, I don't know whether they have recovered from this blight since. Heisenburg was one of the best of them -- one of the great physicists of his time, of course. He's back in Germany, he's active and he's done good work since. Perhaps he's recovered from his German arrogance by now.

One of the most extraordinary things of the war, of course, was that Stimson and Roosevelt backed atomic energy development without any hesitation, completely and fully. This was a courageous thing to do because this development was unlike anything ever seen before. Usually when you are undertaking a development, you can make one part of it, and demonstrate that, or you can make a small-scale model and prove that the theory behind it is right. In the case of the atomic bomb this was impossible. It could be tested only at full-scale, because you can't make a bomb go unless it has the critical mass of the Uranium 235 or Plutonium -- and if it has that when it goes, it goes full-scale. Thus, Stimson and Roosevelt were backing something which was to them only some figures on a piece of paper calculated by physicists. So, of course, were Conant and myself, but we, at least, could understand some of

- 1) WWII
- 2) ATTITUDE OF GERMAN SCIENTISTS TO AMERICA A-BOMB DEVELOPMENT
- 3) FDR & STIMSON BACK ATOMIC ENERGY PROGRAM FULLY

the figures, and we could understand the basis of the calculations. But those two men could not. And I think Roosevelt's and Stimson's courage under such circumstances was extraordinary. [X-REF BACK TO P. 129]

If the bomb had never been successful FDR would have been in quite a spot, when there would have been inquiries in the Senate after the war. I had quite a few talks with him about the hazards run, and I remember I went over the time schedule with him. It was, of course, pretty hard to estimate. We knew by the time that I was talking with him that in all probability we couldn't get the bomb into effect to be of any use in the European war. We just hoped that it would get into use before the end of the Japanese war. When I said, "Mr. President, of course there is a chance that we may not complete (it) in time for this to be useful," his answer was, "We must get completed if we possibly can, for the only safe world after this war will be one where the bomb is in the hands of the Americans only." [X-REF BACK TO P. 129]

I believe he was then thinking about Russia; I can't be sure of this, of course, but it certainly must have been in his mind. At any rate, he knew full well that at the end of the war there would be a great letdown. There was a reasonable chance -- rather, an unreasonable chance -- that in the aftermath of the war there would be great inquiries; but the development of the bomb would be abandoned under pressures of one sort and another. Of course, what I told him was that we'd get it if human intensity could possibly accomplish it.

- 1) WWII
- 2) FDR BACKS ATOMIC ENERGY PROGRAM FULLY
- 3) POSTWAR IMPLICATIONS OF THE A-BOMB

The way in which the money was raised was interesting.

[EH to VB: WHICH MONEY?] [VB to EH: FOR THE MANHATTAN DISTRICT]

Each year, after the Manhattan District had been established, Secretary Stimson and I went up on Capitol Hill and met first with the leaders of the House and then with their counterparts in the Senate. [X-REF BACK TO P. 143] This included, of course, the Chairman of the Appropriations Committee of the House, the Senior Minority Member, and the Majority Leader of the House -- about five or six men. Stimson said very little, but I went ahead and told the whole story without pulling any punches. I told them of the difficulties of development, the enormous cost, the probable timetable, the size of the bomb when it was developed. We included, also, estimates of where we thought the Germans stood. In other words, we told them just as much as we knew. On where the Germans stood, I remember telling the evidence we had. Now this was an excellent way to do it because then the item for the money on the Manhattan District was buried in Army Appropriations; when it came up, for example, in the House Appropriations Committee, the Chairman would say, "Well now, don't inquire into that item, gentlemen; I've inquired into it very thoroughly and I can assure you that it's all right." That's the way the appropriations were put through and of course the appropriations amounted to quite a sum.

An important point here is this: even though we had thus told the entire story to ten men on Capitol Hill or thereabouts,

- 1) WWII
- 2) OBTAINING APPROPRIATIONS FOR A-BOMB DEVELOPMENT
- 3) CONGRESS KEEPS A SECRET

there never was the slightest leak from that source. [X-REF
BACK TO PP. 144 & 219] The people who say that Congress can't
keep a secret are too general in their accusation. In time of
war, on a really important thing, I believe that Congress can
keep a secret and that this proves it.

- 1) WWII
- 2) CONGRESS KEEPS THE
A-BOMB SECRET
- 3) APPOINTMENT OF OPPEN-
HEIMER TO HEAD GROUP
AT LOS ALAMOS

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The story of Groves and Oppenheimer is again a story in
many parts. When Oppenheimer was appointed to head the group
at Los Alamos, Groves took the matter up with Conant and me.
We both knew Oppenheimer's history. Groves had looked it up
very thoroughly and we had quite a conference on it. We had
the evidence of Oppenheimer's leftist tendencies, the question
of whether his wife was inclined to be a Commie, and the question
of his younger brother, who is still more inclined to be. We
also knew that Oppenheimer was highly respected by the scien-
tists. Both Conant and I felt perfectly sure that the man was
loyal. We went over all the angles of the thing and then Groves
made the appointment. [X-REF BUSH TESTIMONY BEFORE GRAY BOARD
IN BBS FILES] He and Oppenheimer worked together very well
indeed. I think that before they got through, they got to
like one another very much, although they were about as different
as two people could possibly be.

Groves' relations with the scientists, of course, were
not so good. He had a counterspy in each organization that
annoyed them no end. [X-REF BACK TO P. 268 AND AHEAD TO P. 420]

They found his military control of the Los Alamos Laboratories annoying and they thought that he was over-zealous on secrecy, but they respected his ability, I think, without much doubt.

At the time that he was appointed, when Styer [VB QUERIES SPELLING] [O.K. FROM AM: MAJ. GEN. W.D. STYER] first recommended his appointment and I'd looked him up, I said to Styer that it wouldn't do at all; I was sure that Groves would get into trouble with the scientists. That held up Groves' appointment as the Head of the Manhattan District and occasioned his coming around to pay his respects to me when he hadn't been appointed at all. [X-REF BACK TO P. 393] After some time, Styer sat down with me again and he said, "Look, there isn't another man in the U.S. Army that can do this job with the skill that Groves would use. We'll have to appoint him, and then you and I'll have to sit on the lid to be sure that he doesn't get into trouble with the scientists." We did just that, to the best of our ability. And I don't think he really did get in trouble with the scientists very much. [EH to VB: CONTRADICTION (last sentence) WITH P. 419.] [VB to EH: NOT VERY MUCH.]

After the war, after the show was all over, the Gray Board sat on the matter of Oppenheimer's clearance. [X-REF BUSH TESTIMONY] You heard parts of this from other places. Groves went before that Board and supported Oppenheimer. He said, "I appointed him, I take the full responsibility for doing so. He performed very well indeed, made an excellent record and I believe, as I did then, that the appointment was a wise one."

- 1) WWII
- 2) APPOINTMENT OF GROVES TO HEAD MANHATTAN DISTRICT
- 3) GROVES DEFENDS OPPENHEIMER TO GRAY BOARD

Groves might well have said, "Before I made that appointment, I took it up with Bush and Conant and they urged the appointment." He didn't say anything of the sort. He took the full responsibility personally and he didn't try to pass the buck in any way. This speaks a good deal for Army training, of course, but it also speaks for Groves' real character.

- 1) WWII
- 2) GROVES DEFENDS OPPENHEIMER TO GRAY BOARD
- 3) GROVES AS A MAN
- 4) THE MUDDY SHOES

The scientists didn't like his counterspying and stuff; [X-REF BACK TO P. 419] neither did I, for that matter. I remember one time I went into a station [EH to VB: PLEASE SPECIFY.] [VB to EH: I THINK IT WAS THE BIG CHEMICAL SEPARATION PLANT.] and there was mud when we went down to look at something. I got mud all over my shoes, and I was supposed to dine with a Colonel that night. When I got back to the Officers Quarters, I had one shoe which was all yellow. Standing over in the corner, looking over everybody, was a fellow who didn't seem to be doing much, so I walked over to him and said, "Unless I'm mistaken (of course he knew who I was) you are one of Mr. Groves' men who is supposed to find things, is that correct?" And he said, "I think sir, you have it approximately correct." "Well," I said, "if that's the case, do you suppose you could find me a shoe brush around here somewhere?" He grabbed them [??] up and got me one.

Groves' counterintelligence fellows were everywhere. At one time I came to the conclusion that one of these chaps was barging into my stuff [EH QUERIES: STAFF?] here and there, so I confronted Groves. When he ducked my question,

I asked him out flatly, "Have you, or any of your people, attempted to find out in any way whatever, anything about my affairs except those that I have told you, or that you might properly consider to be a part of your affairs as well?"

When he had admitted that something of the sort might have occurred, I told him, "You take steps to see that it doesn't occur again." I'm quite sure he did because he knew full well I meant what I said. The scientists ran into this sort of thing and, I think, resented it pretty thoroughly. This made the show a little rough at times but in general Groves and Oppenheimer got along well.

- 1) WWII
- 2) GROVES' COUNTER-
INTELLIGENCE PEOPLE
- 3) ALAMOGORDO--THE TEST

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At the time of Alamogordo, of course, Oppenheimer was very active indeed. Groves, Conant and I were at the ten-mile point, in the open. At the six-mile point were the men controlling the operation; they were in a bunker. At the thirty-mile point, there were a whole lot of observers, including some of the press. The three of us, of course, had nothing whatever to do. We couldn't interfere with anything, so we were just waiting. In fact, we'd been waiting all night.

(Incidentally, I hadn't slept much for two or three days.)

When a rain storm came up in the middle of the night and it looked as though a postponement of at least two or three hours was called for, I saw a tent with a cot in it so I rolled in to get a bit of sleep. Well, the wind came up, blew the tent

down and the rain soaked me. Towards dawn or just after dawn, the test was finally made. Groves, Conant and I lay down on a canvas, for we expected the blast to be pretty severe. In this we were wrong; where we were there was scarcely any blast. The wave had apparently been deflected up by a little rise of ground, and went well above us. [EH to VB: THERE MUST BE SOME EYEWITNESS STUFF. PLEASE LET US DISCUSS.] [VB to EH: OK.]

After the affair, of course, there was great excitement. The teams that were watching for fallout were scurrying all around the terrain. They evacuated some ranches where they were afraid that there might be serious fallout, due to the storm or something else. They lost contact with some of their fellows who were engaged in the same activity; then they were afraid that they'd been doing more evacuation than was necessary and that this would give the show away. There was great excitement.

Finally things began to settle down and we heard that Oppenheimer was going to head back into the hills to get a day or two of rest to recover from the stress. Rabi was going to drive him, so Conant and I walked down to the gate and when the car came by and paused to see us, we stood at attention and took off our hats to Oppenheimer.

We had all come to our rendezvous by different routes, not joining one another until we were there. Great care had been taken to preserve the secrecy; in fact, the Army issued

- 1) WWII
- 2) ALAMOGORDO--THE TEST
- 3) HATS OFF TO OPPENHEIMER

a statement about the explosion of a great ammunition dump and so forth. One man who was at Alamogordo was the Navy captain who started out immediately after the bomb went off and flew out into the Pacific to take command of the aircraft that carried the first bomb. This was Deke Parsons, one of the finest men in the Navy that I ever knew. (He was the fellow that was originally my contact on the proximity fuze [X-REF PROX. BACK TO P. 190] development.) After the war he became head of the Operations Research Organization of the Joint Chiefs of Staff which I established. He died afterwards. He was a great fellow and he beat it for the Pacific the minute the show went off.

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Well, I got a reaction out of it, of course. It was about as great a release of tension a man could possibly have, so I headed for Cape Cod, and spent two or three days there. [X-REF BACK TO "I folded up..." P. 127.] Phoebe was down there, of course. She didn't know what was up: she merely knew that I was in a strange state of released tension. I walked down to the postoffice and the postmaster, and the keeper of the local lumberyard said to me, "How long's the war going to last?" I said, "Oh, a year or two." "Are there any new weapons coming on?" "No, we fired them all off at the Germans."

When I got back to Washington, purposely on the day when things were going to happen, I picked up the phone and got Groves. He said, "The plane is on its way." When I got back

- 1) WWII
- 2) MAINTAINING SECRECY AFTER ALAMOGORDO
- 3) DEKE PARSONS
- 4) REPEAT OF BUSH EXCHANGE WITH POSTMAN ON CAPE COD RE. LENGTH OF WAR

to Cape Cod, after the war, those two chaps said to me, "You lied to us." And I said, "Certainly, I merely hope that I did a good job of it." [REP.(BUT BETTER HERE) X-REF BACK TO P. 127]

One of the strangest things, of course, in the whole Oppenheimer episode, is that Oppenheimer was Director of the Institute for Advanced Study at Princeton and Lewis Strauss was the chairman of his trustees. They had continued for many years, and I guess still continue, in this relationship in spite of the furor over the lifting of Oppenheimer's clearance. Well, we've had since then the Fermi prize given to Oppenheimer at the instance of the scientists and with great discomforture of Hickenlooper in the Senate, which shows where the scientists stand. I think after a bit more, Oppenheimer's clearance will probably be restored. It was a strange episode all the way through and of course merely a part of the strange hysteria in which Americans indulge after every great war. My relations with Oppenheimer during the war, of course, were almost entirely through Conant, because he handled all this angle of things.

My relations with Groves were very direct. But we had a strange organization which I think ought to be commented on here.

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Groves headed the Manhattan District. This was a military organization which he handled as a military man would. It had its contracts, many of them. They were handled exactly as manufacturing contractors usually handled their relations with

- 1) WWII
- 2) OPPENHEIMER A VICTIM OF POSTWAR HYSTERIA
- 3) GROVES AND OPERATION OF THE MANHATTAN DISTRICT

the U. S. Army -- except that a secrecy was maintained very completely and very satisfactorily. (I think the Russians knew far more about the atomic bomb development than did the contractors.) Groves reported to the Secretary of War through General Marshall, as Chief of Staff. That was the regular line of command. Stimson, of course, reported to Roosevelt. But Groves also reported to the policy committee [X-REF BACK TO P. 365 AND FORWARD TO P. 466] of which I was chairman, and of which General Styer and Admiral Purnell were members. Conant was my deputy and I reported, of course, to the President. So there were two channels through which Groves reported to the President. This was bad organization on the face of it. The only reason that it didn't give trouble was that Stimson and I worked together very closely indeed and very smoothly. He always treated me like a son and at some point I have to tell you quite a bit about Stimson and his relationships with me. [X-REF FORWARD TO PP. 710-715]

- 1) WWII
- 2) GROVES & OPERATION OF THE MANHATTAN DISTRICT
- 3) CHAIN OF COMMAND

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Question 89: Churchill...Session at Downing Street....
Cherwell.....Tizard

There are really two parts to Question 89. Take the second one first. Tizard was a grand chap. There's just been a biography written about Tizard and this is going to be published by the Technology Press and I've agreed to put in a short foreword. [EH REC'D. 4/16/65] In this foreword, I credit Tizard for the fine work he did in bringing about American-British interchange on scientific matters and, of course, on the technology of weapons before the United States was in the war. This was not easy but he did it marevolously. [X-REF BACK TO P. 298 AND FORWARD TO P. 701]

There's been a good deal of talk about the battle between Cherwell and Tizard; the biography documents this quite completely. As I've said a number of times, I knew both of these gentlemen. I liked Tizard very much indeed. I was very much interested by Cherwell, and with both of them I had pleasant relationships. But this I know -- no matter if they had a personal feud, neither would have allowed that to stand between him and doing what he felt to be his best duty toward Britain in the war.

Cherwell, in private, was a delightful chap. I remember one night when a group of us gathered and had dinner together with the idea that we were going to discuss some serious matters. Quite a group was there: Cherwell, Portal, myself, one or two others. When we got to dinner, we soon admitted

- 1) TIZARD
- 2) TIZARD-CHERWELL DISPUTE
- 3) THE DINNER FOR "SERIOUS" TALK

that we were plumb tired out, as indeed we were. So after dinner, instead of having a very serious talk, we sat down for perhaps a half or three-quarters of an hour, and told stories. Then we broke up and headed for a good night's sleep if we could get one -- probably in the case of many there, the first good night's sleep in quite a while. That evening, Portal showed us a trick with a matchbox that was a clever thing [QUERY FROM EH] and Cherwell told a story or two. He told them very well indeed. They were excellent stories and we thoroughly enjoyed ourselves. If that had been the only time I had seen Cherwell, or if I had not read things about him, I would say that he was about as delightful a chap as I'd ever seen, with a lot of British reserve, with obviously a strange sort of a mannerism [QUERY FROM EH] and the like, but when relaxed, as delightful a chap as one would wish to meet.

Now I'll undoubtedly tell more about the Tizard Mission in some other place, [X-REF FORWARD TO P. 722] but on Cherwell, the story that went about was this. Tizard was the scientific advisor to Churchill [VB ADDS: NOT REALLY, FROM A FORMAL STANDPOINT.] and Tizard and Churchill did not hit it off. (I always suspected that Tizard, who was a very downright sort of an individual, said yes with the wrong inflection.) At any rate, he was replaced by Cherwell. You have to recognize, however, that the British organization was very different from ours. It did not head up anywhere in the civilian, as ours did, so that the advisor to Churchill was in a very different

- 1) WWII
- 2) THE DINNER FOR "SERIOUS" TALK
- 3) PORTAL
- 4) CHERWELL REPLACED TIZARD AS ADVISER TO CHURCHILL

position. [X-REF BACK TO PP. 176 & 202 AND FORWARD TO 452B]
He did not have an organization under him that encompassed
the whole range of activities. In other words, the British
scientific effort was split up among a whole lot of committees.
How the devil the British ever made this work I never could
understand. They did make it work, but only Britishers
could have done it.

But Cherwell succeeded Tizard. The relations of
Cherwell to Churchill were very different from mine to the
President of the United States. FDR never interfered. He
was interested in all aspects of what was going on but never
did he tell me that I was to do this or that in regard to
any item [X-REF FORWARD TO P. 452D], and he never took steps
in regard to them. (I can give you one story [X-REF TO P. 138]
about how Mountbatten tried to steer him onto something and
how I steered him off. But he didn't interfere.)

Churchill, on the other hand, butted in on all sorts
of technical matters. Churchill, of course, had an ego that
has never been matched anywhere. [X-REF BACK TO P. 176 AND
FORWARD TO P. 724] Just as he didn't hesitate to represent
himself as an expert on military strategy and tactics, he
didn't hesitate to consider himself an expert on the application
of science to weapons. It must have been quite embarrassing:
Cherwell, in the position of carrying out Churchill's orders,
was bound to be in conflict with all sorts of committees and
individuals; and he was.

- 1) WWII
- 2) THE RELATIONSHIP
BETWEEN FDR AND BUSH
COMPARED WITH THAT
BETWEEN CHURCHILL
& CHERWELL

Also this was true: my relations to FDR were primarily as an intermediary. If he asked me a question about weapons or something of the sort, I'd answer it on the spot to the best of my ability, but I'd say, "I'll look that up further, Mr. President." Whereupon, I'd get the best experts on that particular thing there were; I'd ask them to analyze the situation, and post me. Then I would transmit to FDR their opinions, not mine, for they were the experts in the field. Of course, I didn't go back unless I'd found that my own first statement had been incorrect or incomplete. But I always took the point of view that my job was to bring to bear the best scientific judgment that could be found on any point in which the President was interested. That's the situation that obtained in recent years under Killian and Wiesner, and so forth, where they have an advisory committee.

Cherwell, on the other hand, was in no such position. Churchill treated him as his personal scientific advisor and wanted his personal opinions. I think that this was primarily Churchill's fault. I don't believe that Cherwell could have gotten the opinions from the experts readily in any case, for they didn't like him. I know how badly they thought of him because one night out at Oxford in one of the colleges some of the dons recited to me a poem about Cherwell which was scandalous to say the least. [QUERY FROM EH] [JK NOTES: NOW HAVE] [VB SAYS: NOT PRINTABLE.] That was Cherwell's spot and he was really on a spot.

- 1) WWII
- 2) FDR & BUSH
COMPARED WITH
CHURCHILL & CHERWELL
(Cont'd.)

This was apparent when I was in England on anti-submarine matters. Churchill called a meeting of the anti-submarine committee of the Cabinet, so-called, at which he presided. I imagine there were twenty men there; the First Lord of the Admiralty and the Air Chief Marshall and a whole raft of others all around the table. [EH to VB: AT 10 DOWNING STREET?]
[VB to EH: YES, IN THE CABINET ROOM.] [X-REF FORWARD TO PP. 452D, 746, 817-818] The Americans there were Harriman, Admiral Stark, and myself. Of the three, I was the only one, of course, who was thoroughly posted on the anti-submarine technical situation as it was developing. Stark, I believe, had not kept up with the more recent developments or plans. [X-REF FORWARD TO PP. 803-804] However, he was very helpful, as I'd like to say somewhere, [EH to VB: PLEASE DO.] in regard to my relations with the Navy. During that conference, Churchill twice took a crack at Cherwell. I always thought he did this primarily to show me, and perhaps Harriman and Stark, how he handled his scientific crew. At any rate, he took rather solid cracks at Cherwell and Cherwell never batted an eye. Apparently he was used to it, and I judge the rest of the Britishers were too. [PARAGRAPH CUT HERE ON CHERWELL AND TIZARD.] [VB to EH:(re Stark above) Essentials are these. When NDRC was formed the Executive Order stated NDRC was entitled to information necessary to do its job. (This is not exact wording) The Navy balked, and refused to give us the information we needed to proceed on anti-submarine devices and the like. Stark, the CNO, called a meeting -- I think I

- 1) WWII
- 2) THE CHURCHILL-CHERWELL RELATIONSHIP
- 3) STARK HELPFUL WITH NDRC

was alone -- and there were six or eight admirals. I made no argument, simply stated they had the order of their Commander-in-Chief, and I assumed they would follow them. After some discussion Stark told them bluntly to turn over such information as was needed. The Navy, even then, held back for a long time. Our relations with Army and Air Force were much easier. The Navy came over completely only when the proximity fuse succeeded.]

- 1) WWII
- 2) STARK HELPFUL TO NDRC
- 3) CHURCHILL AND ANGLO-AMERICAN ATOMIC INFORMATION INTERCHANGE

* * *

There was another session at 10 Downing Street which was quite a show. This was when the atomic energy affair was in full steam ahead and I knew before I went over that there'd been some quarrel with the British over our system of interchange. [EH to VB: DATE?] [VB to EH: SEE GROVES' BOOK.] Before I left the U.S., therefore, I went to see the President, said that I thought this subject of interchange would come up, and asked for his instructions in case it should. As usual under such circumstances, I got no instructions whatever.

The system was this: we [EH to VB: "WE" HERE MEANS OSRD?] [VB to EH: YES, AND IN MANHATTAN DISTRICT.] had provided in our rules that any man engaged in the development of a project was entitled to all the secret information he needed, of any sort, to carry that project forward. [X-REF BACK TO P. 270] On the other hand, he was not entitled to information which did not meet this criterion. In the field of atomic energy, this meant that the British were brought

into consultation, and given full information on any phase of activities in which they were also engaged. If they were doing fundamental physics or fundamental chemistry on a particular phase of the subject, then they were brought into it. But if they were not working on a particular phase, they were not brought in. This made sense. Groves was administering the Manhattan District, of course, and it worked well. But the British, or some of them, objected.

- 1) WWII
- 2) CHURCHILL AND ANGLO-AMERICAN ATOMIC INFORMATION INTERCHANGE
- 3) CHURCHILL TANGLES WITH BUSH

So when I got to London on this occasion, I went in to pay my respects to the Prime Minister. The Minister for Air [EH to VB: NAME? TITLE?] [VB to EH: SIR STAFFORD CRIPPS] took me in and I expected the proceedings would take thirty seconds. But Churchill sat me down and the Minister left, and Churchill spent ten or fifteen minutes bawling me out on the interchange affair: it was unfair, it was unreasonable, it didn't make sense, he didn't like the arrangement, and he damn well didn't like me. He was sitting at the table in the Cabinet Room and he had a cigar he was trying to light. I guess he hadn't bitten the end off it, and he kept throwing burnt matches over his shoulder in the direction of the fireplace. He kept the First Lord of the Admiralty and somebody else waiting in the anteroom while he hopped all over my frame. I said nothing. When at last he'd come to the end of his tirade I said simply, "The American Atomic Energy Development is now under the Army. The Secretary of War of the United States is in London, and I certainly do not propose

to discuss this subject in his absence." "Very well," said Churchill, "we will have to have a full-dress discussion of it." That ended that particular session. But during the time Churchill had been hopping on me, he gave away most of his arguments and on these I had two or three days to check up and get posted. When the full-dress session did occur, I was in shape.

During the time between the first session and the full-dress session, FDR wrote me a letter. It went to 1530 P Street in Washington and there Conant received it. He cabled its contents to me in London. In going through coding and decoding it got more than a little mixed up. So when I received it and read it, I said, "Well, this simply tells me to do what I'm now doing". So I never altered my course. [Groves tells the story about this, except for that particular letter, I think.] Not until I got back to the United States and saw FDR's original letter did I find out that it practically instructed me to accede to the British position. Now, I don't know whether Churchill talked to FDR or sent him a message on this, but I did adhere to the American position, Churchill finally accepted it, it was put into form by John Anderson and myself, and it was approved at Quebec. FDR did not take me to Quebec, although this was one of the items that was approved there.

Moreover, FDR never mentioned this subject to me. I've always felt that he just didn't care to bring up the fact that he had been persuaded by Churchill to take a stand that would have been very unfortunate. So very naturally I didn't mention

- 1) WWII
- 2) CHURCHILL AND ANGLO-AMERICAN ATOMIC INFORMATION INTERCHANGE
- 3) FDR's LETTER
- 4) BUSH STICKS TO AMERICAN POSITION
- 5) SIR JOHN ANDERSON

it either. But if FDR had ordered me to accede to the British position, it would have made all sorts of trouble for him after the war, had he lived. The Senate could have and probably would have raised a lot of hell about it. The only reason for acceding to the British position would have been to aid them in their postwar use of atomic energy.

[X-REF BACK TO PP. 215, 270, 274] This was not a war matter, and thus FDR's broad war powers did not include it. So I was very happy that FDR accepted what happened at that meeting.

To return to the full-dress discussion at 10 Downing Street, the talk was almost entirely between Churchill and myself. Cherwell and Sir John Anderson were there and, of course Secretary Stimson. Before we went to the meeting, Stimson and I had a talk about what we were facing and I put the case strongly for the American position. He contested it, tried to pick holes in it, and went after me on it. When I put up an argument, he said, "That's the argument of a police court lawyer." [X-REF BACK TO P. 411] But as we were starting into 10 Downing Street he said to me, "Van, I want you to handle this matter." I said, "You mean, sir, that I handle it in accordance with my ideas of how it should be done?" "Of course," said he. What Stimson had been doing was to make sure that I had my arguments in order.

Now there is one incident that we might mention in passing here before I get on to the session itself. I was

- 1) WWII
- 2) ANGLO-AMERICAN ATOMIC INTERCHANGE
- 3) STIMSON BACKS BUSH (& CALLS HIM A "POLICE COURT LAWYER")

staying at Claridge's, where I had a little cubicle about eight feet square. When I found out about the full-dress meeting, I called up Stimson and said, "Perhaps I should come out and confer with you, sir." He said, "No, I'm coming to London anyway and I'll see you at your hotel."

So I went down and said to one of the guys in striped pants, some kind of an assistant manager, or something, "The American Secretary of War is coming to see me; have you a room in which I can receive him properly? The room I'm living in is hardly adequate for that purpose." He obviously didn't believe a word of this, and so intimated, so I said to him, "I suggest that you call up the Aide to Mr. Stimson, the American Secretary of War, and check with him whether what I have just told you is so." And I turned on my heel and walked out of the hotel.

When I came back to Claridge's, somewhat before Stimson was due, the management had moved me to a very beautiful room. Oh, much larger than necessary, all fixed up with chandeliers and what not. I received Mr. Stimson there, and told him that he was responsible for my plush quarters.

Well, we went to the meeting. It so happened that just at this time the Royal Society was giving a dinner for me. I went in and told the major-domo [EH to VB: AT 10 DOWNING ST., OBVIOUSLY] [VB to EH: YES] that I was due at this dinner and that I was quite embarrassed because I was the guest of honor. He said, "We'll see that you get there promptly after the meeting." To jump ahead, when I came out of the meeting,

- 1) WWII
- 2) BUSH GETS LAVISH
QUARTERS AT CLARIDGE'S
TO RECEIVE STIMSON
PRE-DOWNING STREET
SESSION
- 3) THE ROYAL SOCIETY
DINNER AFTER DOWNING
STREET SESSION
--HENRY DALE

the car was waiting for me, we went flying through the streets of London, but not very far, in the blackout. I walked into where the dinner was being held, but dinner by this time was over, and a member was making a little impromptu speech. Sir Henry Dale, then the Head of the Royal Society, greeted me and they all rose. Then Sir Henry said, "Well now, Dr. Bush, I know you have had no dinner. You've been detained by the Prime Minister, and we're all of us used to that. Won't you sit down and have some dinner, and we'll go on talking." So I sat down and they served me dinner. Various people told stories, or made impromptu speeches and then, when I had finished my dinner, they called on me and I talked to the Society about the American effort. I don't think in the United States we quite know how to do that sort of thing as gracefully as the British do.

All right. Now we get back to the session at 10 Downing Street. Churchill started it with a harangue following much the lines as when he had had his private session with me. I was ready for it this time. Moreover, I was quite sore at the old guy for the way he'd gone at me. One of the first things he said was, "Now you understand, I'm interested only in fighting this war; I'm not interested at this time in any question of the postwar affairs of Great Britain, and specifically not interested in atomic energy for peaceful purposes at this time." [X-REF BACK TO P. 270] I said, "If that's so, sir, how does it happen that your representative on this subject in the United States for some time has been a Vice

- 1) WWII
- 2) ROYAL SOCIETY DINNER
AFTER DOWNING STREET
SESSION--HENRY DALE
- 3) SESSION AT DOWNING ST.
ON ANGLO-AMERICAN
ATOMIC INTERCHANGE

President of Imperial Chemical Industries?" Churchill looked at Sir John Anderson and Cherwell to get a negative, didn't get one and went on to the next point.

He said, "Now we developed this particular matter and with particular detail, on this subject and then we turned it over to you Americans to manufacture." [EH to VB: WHAT WAS AT ISSUE?] [VB to EH: A DETAIL, SUCH AS A METHOD OF CHEMICAL SEPARATION.] And I said, "Well, Sir, I have before me the records on that particular thing and I find that the British advice on it began only after we had it in manufacture." After two or three occasions like that, he stopped and looked at the ceiling. There was a long pause and then he said, "I will make you a proposition."

He proceeded to state what was practically the American position and the American plan -- in very different words than those usually used, but that was it. Stimson and I said that we felt sure that the President would be in agreement, and with that the session ended. In other words, Churchill, finding that he had been given incomplete and incorrect information, probably through his own fault, and finding that he had thus taken himself out on a limb, abandoned his contention and conceded the position of the opposition. This, very likely, was characteristic of him. His way of going about it was just what you'd expect from Churchill in wartime.

- 1) WWII
- 2) SESSION AT 10 DOWNING STREET ON ANGLO-AMERICAN INTERCHANGE
- 3) CHURCHILL CONCEDES TO AMERICAN POSITION

Sir John Anderson and I were now detailed to put this agreement in form. Sir John came over to the United States, we worked on it and formalized it. It originally had some clauses in it that were political, that were not concerned with the development but with things quite different. I, of course, said to him that I had no authority to agree on the political clauses. He took this up with Stimson, and Stimson said the same thing. These clauses were largely left out, although I believe one of them got into the thing at Quebec. So that's the history of the session with Churchill at 10 Downing Street. [EH to VB: (This paragraph) OBSCURE AND NEEDS REDICTATION.] [VB to EH: GROVES GIVES MOST OF IT.]

* * *

I saw Churchill only those two times, I think, when I could talk with him. I didn't see him again until he came over to MIT at the time of the big celebration [EH to VB: [AM to EH: APRIL 1961] IN 1948?] [VB to EH: NO, THE CENTENNIAL,] where he was guest of honor, and in quite a little group I was introduced to him. He met me with all indications that he'd never seen me before, and never heard of me. I feel quite sure that he knew me the instant he saw me, unless his memory had become very bad. Because, for one thing, when we had finished our wartime full-dress session and were about to leave, he shook hands with me, and after he got hold of my hand he pushed me around a bit, looked me in the eye and said, "I want to see some more of you," meaning, I think, God help you if I ever

- 1) WWII
- 2) BUSH & SIR JOHN ANDERSON TO SHAPE AGREEMENT
- 3) BUSH & CHURCHILL MEET AGAIN AT MIT

Reel 7-A
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catch you out on a limb. But when he did see me again, he didn't know me. This perhaps was just the fact that he had seen a thousand men and his memory had its limits. I rather suspect that the old fellow didn't want to bring the thing up again. [PARAGRAPH CUT HERE ON VB's CHURCHILL ARTICLE IN THE ATLANTIC MONTHLY OF MARCH 1965, COPY HERE IN OFFICE]

- 1) WWII
- 2) BUSH & CHURCHILL
MEET AGAIN AT MIT

* * *

Question 90: Proximity Fuze

Question 90 is on the proximity fuze and we'll have to come back to this several times no doubt. The proximity fuze was one of the great really marvelous developments of the war, together with radar and the A-Bomb. I think I ought to do two things at first. One, is to talk about the invention of the proximity fuze and the other one is to describe why it was such a difficult development. [X-REF BACK TO PP. 194]

On the first point, Churchill in his book says that the British invented the proximity fuze and turned it over to the Americans to manufacture. Churchill knew better than that. [X-REF BACK TO P. 187] That kind of statement from Churchill was the kind of thing that makes the chaps in this country who really worked hard on the thing a bit furious. I just reviewed the biography of Tizard. It is the story about how Tizard came to the United States and arranged for British-American interchange. The biography says that one of the things that he brought with him was the idea of the proximity fuze. Now in order to understand this situation we have to understand the nature of invention. Let me pause to tell a story.

One time when I was a young professor at MIT and was also a consulting engineer, I was called in by a chap named Dumaine, the father of the present Chairman of the Republican Committee in Massachusetts, who was then operating the Waltham Watch Company. He told me that he'd made a very great invention and that he wanted me to develop it for him. He had

- 1) WWII
- 2) BRITISH CLAIM INVENTION OF PROXIMITY FUZE
- 3) FLASHBACK--BUSH AS PROFESSOR AT MIT & THE INVENTION OF DUMAINE OF WALTHAM WATCH

invented a watch which would run without winding; it had a little radio receiver in it and this picked up energy from all the broadcasting stations and this wound the watch. All that I was supposed to do was to take that idea and develop it. Well, of course, I said very little to him about the amount of energy thus receivable and the size of radio sets and so forth. I merely said that I'd think it over. Of course I never went near him again. Now that chap had the concept that the mere formulating of an idea constituted an invention.

Now the proximity fuze. It was perfectly evident to a host of people that if a fuze could be built which could cause a shell to explode in the vicinity of an airplane, it would be a very great improvement in aircraft defense. Hundreds of people thought of that, no doubt. Of the hundreds, dozens thought, well, now, we can do this by putting a radio set in the fuze. Now of course you can put a radio set in a critical condition so that if you get near it, it will squeal: so, make the squeal set off the fuze. They thought of the old musical instrument where a chap could wave his hands. [EH to VB: THE THEREMIN?] [VB to EH: YES.]

That was comparable to Dumaine's idea, and it was in that stage. No doubt a dozen Britishers also thought of that, and thought no further. No doubt a dozen Americans thought of it also. And that is no contribution whatever by anyone toward the consummation of the idea.

- 1) WWII
- 2) FLASHBACK--BUSH AT MIT & DUMAINE "INVENTION" (Continued)
- 3) PROXIMITY FUZE

If that were considered invention, then hundreds of people on both sides of the water invented the proximity fuze. However, if we take the patent-statute concept of invention, this was most certainly not an invention. The patent statutes state that an invention is "a novel combination which is useful."

[EH to VB: FIND EXACT PHRASE] [VB to EH: NEW AND USEFUL COMBINATION.] In order to have an application for a patent considered, the application must show a device which is operative. No such thing was shown until a group of men in the United States put together a design which it was possible to construct and hence make use of. That was when the invention occurred in the legal and also in the practical sense. I don't doubt that Tizard passed on the idea of the proximity fuze, but this was a very long distance from a proximity fuze itself.

Now, why was there such a gulf in this case? What was contemplated? What was contemplated was that one could design a radio set, compress it into the size of, let's say, a small baking-powder can, insert it in a shell -- and mind you this radio set would have thermionic tubes in it, with delicate filaments and so forth. When the shell was fired from a gun, the radio set, if it actually weighed a couple of ounces, would press down on its base with a force approaching a ton at the moment of firing, because of the enormous acceleration of the shell in the bore of the gun. One would then have to expect that, after this experience, this delicate radio set, with all its parts, would not only be in operating condition,

- 1) WWII
- 2) BUSH--"AN IDEA DOES NOT CONSTITUTE AN INVENTION"
- 3) WHAT WAS CONTEMPLATED FOR A PROXIMITY FUZE

but could still be adjusted to such a delicate point that it would sense the presence of an airplane quite a distance away. Remember that the old Theremin, so-called, around which a chap waved his hands, operated only when the hands were a foot or two away. But the set we're talking about now had to respond to the presence of an airplane a hundred feet away. Also, we have to remember that the shell is steel and that steel is a shield for waves, electromagnetic waves. Yet the radio set was supposed, somehow, to get out into the space around it, a field, an alternating field, of very high frequency so spread, and so sensitive, that it would sense when an airplane was near. On the face of it, the idea was impossible.

The real beginnings of the proximity fuze occurred when three or four chaps including Merle Tuve and Larry Hofstad and I think Phil Abelson and Dick Roberts came into my office and said they wanted to get to work developing it. I raised all the objections such as I've recently recited. To each, they responded with plans and schemes for getting around the difficulty. I finally said to them, "Quite frankly, I think this is an impossible task, given present-day techniques, in any reasonable time. Nevertheless, I recognize that you chaps have thought about it thoroughly, that you're all highly competent in this field and that you, the three or four of you, are convinced that there is a real chance of success. This being the case, in spite of my qualms, I'll back you up while you try it." [X-REF BACK TO PP. 186-187] A section was formed especially for this purpose. It was placed under Dick Tolman

- 1) WWII
- 2) BEGINNINGS OF PROXIMITY FUZE--
TUVE & TOLMAN

and the development proceeded. It not only proceeded, but in a remarkably short time, it was successful.

I can remember a number of tests of the fuze. [X-REF BACK TO P. 189] One of the most striking was on a beach somewhere down in the Carolinas. [EH NOTES QUERY] [X-REF BACK TO PP. 187-188] A battery of ninety-millimeter guns was set up -- radar-controlled, so that the guns pointed themselves. The radar picked up a target, a computer computed the speed and course of the target and put in the corrections so that the shell and the target should arrive at more or less the same point at more or less the same time. The guns were loaded with proximity-fuzed shells. A robot plane, a target plane, was put up, so far away that one could barely see it with the naked eye; we watched it through binoculars.

As the plane, as the target, streaked across in front of us, the guns opened up. Sometime later the first shell struck the robot; it began to tumble. As it fell toward the water, shell after shell hit it -- for the computers not only followed its horizontal flight, but picked up the vertical flight as well. It was a perfectly extraordinary experience. After seeing it, and realizing that this could be done even when it was foggy or cloudy, one felt that the day of the airplane's immunity was approaching an end very rapidly.

[EH to VB: AS RECOUNTED, THIS FEAT SEEMS MORE ATTRIBUTABLE TO THE COMPUTERS THAN TO THE PROXIMITY FUZE. HOW COME?]

[VB to EH: WITH COMPUTERS ONLY PERHAPS ONE SHELL IN FIFTY WOULD HAVE ACTUALLY HIT THE VERY SMALL PLANE AT THAT DISTANCE.

- 1) WWII
- 2) REPEAT OF TEST OF P.F. IN CAROLINAS

WITH THE FUZE THEY NEARLY ALL EXPLODED BEFORE THEY GOT TO IT,
AND SPRAYED IT WITH SHRAPNEL.]

- 1) WWII
- 2) PROXIMITY FUZE HELPED
END BUZZ BOMB ATTACKS
ON BRITAIN

* * *

Out in the Pacific, it was stated that the proximity fuze improved the deadliness of the five-millimeter [EH to VB: PLEASE CORRECT ERROR] [VB to EH: WAS IT THE NAVY FIFTY CALIBRE ANTI-AIRCRAFT GUN? I THINK SO.] anti-aircraft guns by a factor of five or seven, and I've even heard ten -- no one could exactly measure, I imagine. But undoubtedly the proximity fuze gave a cruiser which was being attacked by Kamikaze and the like several times the protection it had previously had against aircraft. [X-REF BACK TO PP. 167 & 188] For this reason, because it was so deadly, because it worked so well, orders were issued that it should be fired only over water. [X-REF BACK TO PP. 172, 188-189]

During the buzz-bomb attack on Britain there was at first no really good protection. Then a bunch of anti-aircraft ninety-millimeter guns with proximity fuzed shells were set up on the British coast where they could fire at the V-1's [X-REF BACK TO P. 188] and still have their shells land in the water. This practically ended the V-1's. The proximity fuze was not much good against the V-2's because these rose so fast that radar didn't have time and couldn't keep up with them to direct the guns. The defense against the V-2 was a very different story.

Because of the great success and value of the proximity fuze, the Joint Chiefs took the position that the shells should be fired only where they would land in water, so that there could be no possibility that a dud might get into enemy hands. Yet it soon became apparent that the shells would be exceedingly valuable on land in timed-fire. This requires a bit of explanation.

- 1) WWII
- 2) REPEAT OF PROXIMITY FUZE USED ON LAND

In artillery fire against personnel the most effective method used to be high-angle fire so that the shells' trajectory would come down [?] bring it steeply toward the ground. When the shell explodes at a proper height, the shrapnel then forms a deadly cone against men on the ground, and will get men in foxholes as well as in the open. This is done ordinarily, or used to be, by timed-fire: that is, a time-fuze in the shell causes it to explode at the proper moment. Now if the artillery observer can see the ground where the shells are falling, he can apply corrections as he sees shells explode too high or too low. But it is a very inaccurate method. And if the ground can't be seen, no corrections can be made. Of course if all ground were perfectly level everything would be much easier, but the elevations are different at the gun and at the target. By dramatic contrast, the proximity fuze needs no setting at all. It will explode its shell as it approaches at just the right elevation. It hence can be very deadly indeed.

For this reason it was most evident that there would be great military benefit if we could get these shells in use in France. In accordance with that idea and by one method or another, some four million shells, I think, were either in Europe or on the way there . . . (Of course, some of them were in Britain where they were used for anti-aircraft defense.) A number of us were very anxious to see them in use in the lines against the Germans.

One man thus heated up was Joe McNarney. He was then, I believe, Deputy Chief of Staff of the Army. The Joint Chiefs, on the other hand, had taken the position that there was too much danger in doing this, that the enemy would get a dud, and copy it, and not only use it against our bombers in Europe but give it to the Japanese. For this reason, the Navy and the Air Force opposed any use of the shells over land. Joe McNarney and I got together; his belief was stated that he could convince the Air Force if I would take on the Navy. [X-REF BACK TO PP. 191-193 AND FORWARD TO P. 816]

So I went to see Admiral King and we had quite a session. I well remember how it opened. Admiral King said that the subject was a military one on which civilian opinion was not important. I rejoined that we were discussing a combined civilian and technical-scientific subject, with the principal emphasis on the latter, and that on the latter part of the subject he was a babe in arms, not entitled to any opinion at all. I didn't know but I'd be thrown out of the office. The session was stormy but eventually we were able to discuss

- 1) WWII
- 2) PROXIMITY FUZE USE
ON LAND (REPEAT)
- 3) BUSH & JOSEPH McNARNEY
CONVINCE JOINT CHIEFS
TO ALLOW USE OF P.F.
(REPEAT)

things dispassionately. I told King that we had had a committee of top-line engineers who had been given the assignment of estimating how long it would take the Germans or Japanese to manufacture the fuze if they were given an intact dud which they could examine at their fullest pleasure. The reply of this group was that it would take them at least two years; I told King that this was, in my opinion, a conservative estimate.

I finally convinced him. I have to say this for Admiral King: he was a martinet, he was a tough egg, (as has been said of him many times), but he also was intellectually an honest man. When I finally convinced him, he said, "There's going to be a Joint Chiefs' meeting this morning in half an hour; will you go with me?" I said, "I most certainly will." I went before the Joint Chiefs with him and King asked the questions to bring out my arguments. Shortly after, the Joint Chiefs released the shell for use over land. And within -- I think it was twenty-four hours, but it may have been forty-eight -- I was on the way to France.

With me was Colonel Cox, my aide, and also General Waldron [X-REF BACK TO P. 168 AND FORWARD TO P. 757] who was at that time Chief of Requirements of the Army. Now Waldron was the man who took the artillery into Buna [BURMA?] over the mountains at the time when we were stuck there. In the process he'd taken a piece of shrapnel in his shoulder so that he'd spent six months in the hospital. His right arm wasn't much use; he couldn't raise it very far. But he'd got himself restored to active duty. He was a perfectly swell chap.

- 1) WWII
- 2) BUSH & McNARNEY
CONVINCE JOINT
CHIEFS TO ALLOW LAND
USE OF P.F. (REPEAT)
- 3) BUSH GOES TO FRANCE
WITH COX AND WALDRON
TO SEE BEDELL SMITH
(REPEAT)

Waldron and I [?] went down to see Bedell Smith at Versailles, and had a rugged session with him. When I went in, or just before we went in, I said to Waldron, "Now this is a military matter, so you take it up with Smith and I'll back you up on the technical aspects." He said, "Not at all; you are the chief of this mission, I'm merely delegated as your aide and I'll accompany you in there to support you on military matters." So that's the way we left it.

- 1) WWII
- 2) PROXIMITY FUZE
- 3) BUSH SEES BEDELL
SMITH AT VERSAILLES

I knew Bedell Smith well; he'd been Secretary of the Joint Chiefs. When I came in, he said to me, "What in the hell are you doing over here? Haven't we got enough civilians in this theatre without you butting in; we've got to fight a war without you guys all barging around here...", and a few more words to that effect. I said, "I came over because you chaps are about to spoil one of the most important weapons of the war simply because you don't take the time to learn what it is." With that start we got along marvelously. Finally he said, "All right, all right, what do you want me to do?" And I said, "I want you to give certain orders to G-1 to insure the introduction of the fuze simultaneously in all Divisions. I want you to give certain instructions to G-4 so that the shells will be moved up in time for that opening." [EH NOTES QUERY re. that opening] And I reeled off exactly what we'd agreed to on the way over. [EH NOTES QUERY] He said, "O'K', O'K', I'll do that. Now, there isn't anything else you want is there?" And I said, "Well, I want an automobile to

get up to the front because the Ordnance officers in your divisions, your Chief Ordnance Officers, don't know anything about this fuze and they've got to be told." He said, "Well, the trouble is that you say the Joint Chiefs have released it, but I've no word to that effect yet so I can't tell the Ordnance officers about it." I told him that I didn't report to the Joint Chiefs, that they had no control over me whatever, that I reported to the President. Moreover the secrets that we were talking about were not secrets that had been told me by the Army, they were secrets that I had told the Army. He could prevent me from going to the front of course, but if I got near an ordnance officer on the front he couldn't possibly prevent me from telling him about it. He grinned and called an aide and told him to facilitate my movements. Then was the time that he asked me about the A-bomb which I've recited elsewhere. [X-REF BACK TO PP. 169 & 413]

I visited the front in various places. The Chief Ordnance Officers of the divisions [X-REF BACK TO P. 193] were drawn back so that I could give them the story. They'd never heard of the thing. There was nothing to tell them about how to use it except to explain what it would do and why it would do it and issue certain cautions so that they wouldn't shoot down their own reconnaissance planes. This involved the trajectories and the time after firing before the shell became activated, and so on. Colonel Cox had studied this very assiduously so that if I got stuck on a technical point, he'd promptly supply it. We moved along and

- 1) WWII
- 2) BUSH EXPLAINS USE OF PROXIMITY FUZE TO ORDNANCE OFFICERS IN EUROPE (REPEAT)
- 3) USE OF P.F. IN BATTLE OF THE BULGE (REPEAT)

did this, and then Cox went down to Italy and did the same thing there.

The result was that the shell was introduced suddenly all over the place just before the Battle of the Bulge. [X-REF BACK TO P. 193] During the Battle of the Bulge it caught German divisions in the open and decimated them. The Germans had been waiting for a period of bad weather when not only would our aircraft be unable to fly and find them, but also our artillery would not be able to use time-fire against them effectively. Hence the proximity fuze caught them in fairly dense groups, in the open. Shells coming down on them and exploding at the proper level knocked the spark out of them. After the battle General Patton remarked (I got this indirectly, of course) that henceforth the whole tactics of ground warfare would have to be revised. And he said that this undoubtedly saved Liège. I don't know. I read about the Battle of the Bulge many times. I don't know just how much effect it did have, but I know that it was important.

* * *

As soon as the shells began to be used in France, we moved teams of civilians up behind the front in trucks equipped with all sorts of electrical gear. The task for these teams was to watch the German's radiation to detect the first time they started to counteract the shells by jamming. But, incredibly, there was no jamming. The first shells used in France were shells of the first production which could be

- 1) WWII
- 2) USE OF PROXIMITY FUZE
IN BATTLE OF THE BULGE
(Repeat)

relatively easily jammed. They were followed by shells that were much harder to jam. We hoped that the Germans would get wind of the first shells, and proceed to arrange a rather complex jamming apparatus, get it to the front and that just about the time this happened, the type of shell would be changed and their jamming equipment wouldn't work. But right through until the end of the war there was no such jamming.

After the war was over we found out that, just as soon as these shells were fired, the front reported to Berlin that the Americans were using an electrical proximity fuze shell. Berlin replied that this was impossible. The argument went on, with the result that no real program to jam the shells was ever put on by the Germans. This is rather an extraordinary commentary on the way German science and technology worked with their military -- or rather did not work. [X-REF BACK TO PP. 171 & 193]

There's another point here that's an interesting one. We heard an awful lot about German espionage. Now these proximity fuze shells were made in dozens of factories in this country. True, one part was made here, and another part there, but they had to be assembled, so hundreds of people knew all about them; that is, knew how they were built and what they were for. They'd have been completely blind if they hadn't known. Yet the Germans never found out about them. If they had, and if they'd known the fuzes were going to be successful, they would have promptly got to work to jam them. Earlier I've recited the firings down on the Carolina coast. There

- 1) WWII
- 2) GERMANS DENY EXISTENCE OF P.F. SO NO JAMMING
- 3) SECRET OF PROXIMITY FUZE WELL KEPT

were plenty of troops around and the troops would have included a good many amateur radio hounds. If these boys hadn't been able to tell what was going on, they would have been exceedingly obtuse. Yet with all of that material, the Germans as far as we can tell, never got a whisper of what was going on until the shells landed on them. This is one of the things that makes me so irritated when I pick up one of these spy stories that are quite popular these days.

[? to EH: Keep that. It's a recurring cult.]

Now another thing about this is interesting. The fuze was one of the most important developments of the war from a technical standpoint. Yet, when I went to Versailles, and talked to Bedell Smith, who had undoubtedly told Eisenhower about it promptly, I had no word with Eisenhower about it myself. Oh, he was busy as the very devil, of course. But you would have thought that with a thing like this entering into warfare, he would have wanted to ask a few questions himself. He didn't. This is a part of the story that I've recited before. [X-REF BACK TO PP. 174-175, 410, & FORWARD TO P. 469] Eisenhower, Marshall, some other senior officers, ignored the technical developments, not only because they were busy as the devil, but also, no doubt, because they thought that if they tried to enter into them, it would be a long tough job. It would take time better applied elsewhere. Also, I suspect, many of them could not face the technical revolution in warfare which was then just beginning to be evident.

- 1) WWII
- 2) REPEAT OF EISENHOWER,
MARSHALL IGNORE
TECHNICAL DEVELOPMENTS

An exception, of course, was Jake Devers -- and of course there were others. I was in Devers' command area about to indoctrinate some of his ordnance officers. I was at breakfast in the officers quarters and I was going to meet in a few minutes with some of the ordnance chaps who'd been brought back for this purpose and in came Devers. He galloped over, shook my hand and said, "I hear you've got some great stuff. Go to it, old man; I wish I could stick around and listen to the story. But," he said, "I've got a flight going on this morning and I've got to get over and see about that." And out he went. [X-REF FORWARD TO PP. 762-763] Devers would have been delighted to get the details of the fuze. Having gotten them personally, he could have helped without doubt in the appropriate uses of it and so could other chief officers. In general throughout the war, it was not the men in the top ranks who were the really helpful persons, and who worked with us.

I remember one instance when Marshall got hold of me. The Japanese bunkers in the Far East were proving very tough; they absorbed ordinary artillery fire, which thus didn't wreck them. They were made out of pulpy palm logs which weren't knocked out all over the place when a shell hit. Marshall asked if there was anything technically that might help on this and I told him, "Yes, there are three or four things that might be of real use." I told him I'd be glad to take one of his officers and see that he was made acquainted with every possibility and then if they could give me some ideas as to

- 1) WWII
- 2) JAKE DEVERS EXPRESSES EXCITEMENT OVER P.F.
- 3) MARSHALL ASKS FOR HELP IN DESTROYING JAPANESE BUNKERS BUT STILL IGNORES TECHNICAL DEVELOPMENTS

how things could be modified to advantage, we'd see that that occurred. So his, I guess, Chief of Ordnance [EH to VB: QUERY] [VB to EH: BURDEN, I THINK HIS NAME WAS, IN ORDNANCE BUT NOT CHIEF.] came over and I put him in touch with the people who were developing various kinds of rockets for beach landings and all sorts of gadgetry of that sort. On^e particular gadget, which was not then ready, as I remember it, but which later proved very effective, was an infrared affair by which one could see at night, and even aim a gun at night -- the sniper-scope. [QUERY BY EH] I posted General Marshall's man on everything he needed to know, and he got something shipped out to the East, I believe, and he went out there himself.

- 1) WWII
- 2) MARSHALL ASKS FOR HELP IN DESTROYING JAPANESE BUNKERS BUT STILL IGNORES TECHNICAL DEVELOPMENTS

When he came back, Marshall called him in and congratulated him on some of it, according to his story to me. But Marshall never again said a word to me about that subject. I don't know whether that particular thing really helped against the bunkers or not. All I know is that I got some of my best people working on it, and that Marshall was not interested enough to take it up beyond that first few words. Well, don't misunderstand me, I had great admiration in many ways for Marshall.

* * *

Now this is by no means the whole story of the proximity fuze. I might add one more point. When I was moving along the front to talk to ordnance officers, I spent a night in a place called Vermiel [EH to VB: CAN'T MAKE OUT ON TAPE.] [VB to EH: SMALL TOWN NEAR VERDUN. I'VE NEVER SEEN IT SPELLED,

BUT IT SOUNDS LIKE THIS.] up near the front. We were sitting around in the evening in a little inn that had been hit by a shell but not quite knocked over. One end of it was off its foundation and it was on a slant, but it was still standing up. A number of officers had come down from Antwerp to get hold of me because they were getting pasted with buzz-bombs in Antwerp. They wanted to use proximity fuzes against them but the ban was still on as far as they were concerned: the release from the Joint Chiefs had not yet reached them: so they wanted my help in this matter. Since there was no furniture, we sat around on the floor and discussed things. Somebody broke out a bottle of Hennessy's Four-Star brandy that had been manufactured for the Wehrmacht (so it said on the label) and we passed this around the circle. Soon the lights went out and, this being a French town and the lights from a French station, we knew perfectly well there'd be no more lights that night. We sat around in the dark and continued to discuss, and pass the bottle of brandy. When I got back to Paris the next day or so, I promptly went to my office (which had been moved from London to Paris as soon as Paris was liberated). There I found that this problem of Antwerp had already been resolved, that permission to use the shells had reached the troops over there and there was no problem to attack.

My London office was run by Bennett Archambault who is now the President of the Stewart Warner Corporation. [X-REF AHEAD TO P. 723] When he moved to Paris he had about him the

- 1) WWII
- 2) THE EVENING IN THE DARKENED HUT DISCUSSING THE BUZZ BOMBS ON ANTWERP & THE BAN ON THE PROXIMITY FUZE
- 3) VB's EUROPEAN ASSISTANT -- ARCHAMBAULT

doggonest crowd of youngsters that you can imagine. They were all in uniform (and so was I for that matter) but it was an officer's uniform without insignia. We would not put on our shoulders a sign saying that we were scientists or something, as the war correspondents did. We insisted, and I was backed up on this by Stimson, that we wear officers' uniforms without insignia. This made things very convenient, because the young technical fellow who knew a subject very thoroughly could talk with a senior general and not be in the position of a junior officer talking to a very senior one. It also had the extraordinary effect that there was no rank among us. I wore the same uniform as the youngest chap in the outfit. It worked very well. We did the same thing with the Navy in the Far East.

On this particular occasion when I got to the office there in Paris, it was a beehive with people coming and going and in little groups talking excitedly. I'm pretty sure they were under Archambault's control. He controlled them all right, there wasn't any question about that. While the activity was great there was no risk to security in that place. [EH QUERY]

* * *

[THE FOLLOWING MATERIAL UP TO BUT NOT INCLUDING PAGE 453 IS FROM VB's LETTER TO EH OF APRIL 15, 1965.]

- 1) WWII
- 2) WEARING OF OFFICERS' UNIFORMS WITHOUT INSIGNIAS BY SCIENTIFIC PEOPLE

[THE FOLLOWING MATERIAL UP TO BUT NOT INCLUDING PAGE 453 IS
FROM VB's LETTER TO EH OF APRIL 15, 1965.]

It would be very interesting indeed to obtain comments
on British research organization and allied matters. He was
in charge of the London office of OSRD, where he did a bully
job, and he is now president of Stewart-Warner.

Conant went over and set up the London office, and this
helped because the British had respect for Harvard University.
But then Archambault took over. He was no recognized scien-
tist. In fact, after graduating at MIT, he had his first
experience in Wall Street. The British were, I think, jarred
by this appointment. The head of their Washington office was
Charles Darwin. But they later agreed that we had the right
idea in choosing a younger man.

A good illustration of the degree of decentralization in
OSRD is the following. After Paris was liberated Archambault
removed his team to Paris. Now he reported formally to the
Chairman [of] NDRC. But I doubt very much if he obtained
Conant's approval before making the move. Certainly I did not
know about it until after it had occurred. Then, when I visited
that Paris office I found it a hive of activity such as I have
seldom seen.

A good example of his skill in management is this. When
I saw him on the trip he told me of a young physicist on his
staff who was working so intensely he was about to crack, but
that he felt sure it would be just the wrong thing to do to
make him slow down. So he suggested a solution. When I got

- 1) WWII
- 2) COMPARING BRITISH &
AMERICAN RESEARCH
ORGANIZATION IN WAR
- 3) ARCHAMBAULT

back to Washington I wrote Arch a letter, said I regretted stealing one of his good men, but I needed this physicist for a special assignment, he was uniquely fitted for. Then I put him on a task where he was in the field and there were inevitable pauses in activity.

But what I would like to arrive at is a good discussion of the difference between British and American practice, and I would like to get Archambault to comment and add. We might also get in a bit on German research organization, which was terrible. But it would be well to have the British-American analysis, not that organizations are ever copied exactly, but their principles may be.

As I see it there were several fundamental differences:
(1) the British organization was almost entirely advisory; the American was operative; (2) in Britain there was a tendency to move all decisions toward the top layer of organization; in America the effort was to keep decisions at the operating level; (3) the British research and advisory organization was complex and not centered; in America for nearly all the civilian effort we had a pyramidal structure reporting to the President. [X-REF BACK TO PP. 176, 202, 426 & FORWARD TO P. 724]

Point 1 is of course not absolute. There were civilian efforts in Britain not controlled by the military. But most of the work was under military control with civilian advisers. Some of these advisers had great and salutary influence, notably Tizard, but the authority was in the hands of military men,

- 1) WWII
- 2) COMPARING BRITISH &
AMERICAN WARTIME
RESEARCH ORGANIZATION

or their civilian ministers, or finally the Prime Minister. In the U.S. advice was furnished at times by OSRD. This was usually done by finding the men. For example on ALSOS we helped Army Intelligence to set up a team, which they then operated. Similarly on intelligence regarding buzz bombs, or on estimates of bombing. The same thing occurred when Operations Analysis became used. But on research and development on weapons, OSRD ran its own show, with military men sitting in and conferring at all levels of the organization. The heart of the matter was that OSRD had its own funds, appropriated by Congress, expendable by authority of the Director.

An excellent example is the Dukw. At NDRC level, and in the section that initiated this program, the Army opposed the program. Yet it went ahead, succeeded, and produced valuable results. I have told much about this and could tell more. Somerall's opposition, Ike's message to Marshall, my talk with Stimson, Putnam's visit to seven theatres, Devers' aid, tests off Provincetown, the amphibious jeep, the snow vehicle, the trick of getting instructors to Africa, the task in Virginia and at Monterey. But the main point is that, having the money, and reporting only to the President, OSRD could not be stopped by military obstructionists, of whom there are always some present.

The reasoning behind point 2 is this: the war from a technical standpoint was so complex that no man could grasp it all to an extent which would justify him in making decisions. Yet, in Britain, all sorts of decisions were made at the high

- 1) WWII
- 2) COMPARING BRITISH
& AMERICAN WARTIME
RESEARCH ORGANIZATION
- 3) DUKW

levels, and even by the Prime Minister and his advisor, Cherwell. This led, among other things, to conflict between groups. This comment should not be misunderstood. The pre-war decision to push radar in Britain had to be made at the top, and if it had been made wrong the Battle of Britain would have been lost. Also we have to remember that, during the war Britain was being bombed, had limited resources and manpower, whereas in the United States men and money were nearly unlimited. Still the point has validity. For example, while I conferred with all the top Navy men in England on antisubmarine measures, I did not pretend to be an authority on the subject, my conferences were primarily to see if they had criticisms of our program or suggestions of where we might do more. The OSRD team on this, working closely with the Navy, spending full time on it, really knew the subject. Neither NDRC or I would have thought of over-^hfuling their judgment as to where to put emphasis and so on. Yet, when I sat with the British Cabinet Committee on Antisubmarine Warfare, the Prime Minister presided, and there was every evidence that the people present were advising him, and that he might at any time make a decision affecting them all. [X-REF BACK TO P. 428 & FORWARD TO 746, 817-818] This was in contrast with my sessions with FDR, when I told him on new devices and their prospects, in which he was keenly interested, but had no intention whatever of judging or interfering. [X-REF BACK TO P. 427]

- 1) WWII
- 2) COMPARING BRITISH
& AMERICAN WARTIME
RESEARCH ORGANIZATION
- 3) CHURCHILL PRESIDING
AT CABINET COMMITTEE
VS. FDR

Point three was important. The British advisory structure continually altered. At times there were attempts to streamline it, but they never worked. Only the British could have made it really function, which it did to an extraordinary extent. At first, and until we really got going, they beat us on radar. True, they had the spur of imminent assault, but we had far greater resources. They completely muffed on the A-bomb, not that they could have carried out such a program under war conditions, but they misjudged it in various ways, and I think most of this was due to the confusion of their organization. Our great strength was largely due to our pyramidal structure. We could not have a contest between sections as to jurisdiction for example, because there was an authoritative means for settling it promptly. A group could not run wild, although some of them tried to, involving us in a jam with Congress, or the Budget, or the General Accounting Office, or the Secretary of War, or the Joint Chiefs, for in the last analysis the Director held the purse strings and there was no appeal. Many things that the sections did could be accomplished only by collaboration with military units, for example on field tests with new devices. Here persuasion, influence, had to enter. The sections in general got along well on this, for they included keen enthusiastic military officers on their membership, both formally and informally, and these men knew how to get what was needed. Still, it was important throughout the war, that the Director could appeal

- 1) WWII
- 2) COMPARING BRITISH
& AMERICAN WARTIME
RESEARCH ORGANIZATION

Reel 7-B
Page 452-F

to the President, or the Secretary of War or Navy, and equally important that he did not do so. I remember only one situation where I really appealed to FDR for support, and this was on a medical matter. [X-REF BACK TO P. 404]

- 1) WWII
- 2) COMPARING BRITISH
& AMERICAN WARTIME
RESEARCH ORGANIZATION

Don't think I worked out all of these policies personally. I had a marvelous team in the top echelon, and some policies just grew like Topsy. I think the only very important move that I made essentially alone was, when OSRD was formed, seeing to it that all authority resided in its Director, and I do not think I would tell about that even now.

[THE FOREGOING MATERIAL (452-A through 452-F) IS TAKEN
FROM LETTER OF VB to EH DATED APRIL 15, 1965.]

* * *

Question 91: The Dukw:

The story of the Dukw is quite a story. It's wound around a section of NDRC (Div. 12) over which Hartley Rowe exerted as much control as anyone could have in that particular group of wild men. It included Palmer Putnam, Rod Stephens and quite a gang of ingenious, resourceful youngsters who did all sorts of things.

One of the first things they did was to build an amphibious jeep. Then they built a weasel to go over snowfields and finally the Dukw. [EH to VB: QUERY RE. WEASEL.] [VB to EH: THE WEASEL, A SNOW VEHICLE, EMERGED FROM ONE OF PIKE'S WILD IDEAS, NO DOUBT TREATED ELSEWHERE.] Putnam was the moving spirit of the show. When he was on some sort of an affair, he was likely to spend money like a drunken sailor, and to plow through all sorts of obstacles. [EH to EH: THE GM DERIVATION OF D-U-K-W MUST BE EXPLAINED.] [VB to EH: PALMER PUTNAM CAN GIVE IT.] Every once in a while somebody in the outfit would come to me and say that I had to curb Putnam, that he was interfering unduly with things and so on, or that I ought to fire him. I always replied that as long as Putnam was producing results in the way he was producing them, I was not going to interfere with his methods. I stuck to that although I lot of people didn't like it.

Now I don't know who supplied the ingenuity; I think the whole group did, as a matter of fact. But you couldn't sort them out. Putnam certainly applied the steam. The first thing,

- 1) DUKW DEVELOPED BY NDRC SECTION HEADED BY HARTLEY ROWE
- 2) PALMER PUTNAM -- "MOVING SPIRIT OF SHOW"

the amphibious jeep was certainly successful. I remember some tests of it where it went plunging through pine trees (with a general aboard along with Putnam, hopped off a bank into the water and swam around. That was quite a striking affair. [X-REF AHEAD TO P. 763-764]

The business of the snow vehicle came out of some of the Norway plans. I think during the war it had no real use, but after the war it came into use all over the place -- or copies of it, at least. [X-REF AHEAD TO P. 694] That sort of vehicle is much used now in South Polar exploration. The Dukw however was the crowning achievement of this particular group.

Now somewhere I'll tell the story of General Motors in this connection [X-REF FORWARD TO P. 725] I don't think General Motors really had anything to do with this development, but the story ought to come in at some point. It involves patent relationships.

However Hartley Rowe's group got it done; they built a Dukw. The Dukw was simply a converted army truck which was given a propeller and had a body which had been made watertight. It had extraordinary qualities. To help it get up a beach, there was a provision so that, from the cab, you could lower the tire pressure to get over the soft sands; then on getting back to a highway you could restore the tire pressure to normal. There were all sorts of experiences with it. I saw some pictures taken of its tests on the Pacific Coast, where it went out to sea through surf that was measured, so

- 1) WWII
- 2) THE PROPERTIES OF THE DUKW

they say, at somewhere around twenty feet. I didn't see this in person but I did see it operate through fairly rough surf off Cape Cod, in the East. [EH to VB: CORRECT ASSUMPTION?]
It was an extraordinary thing to see; the Dukw would wade into the surf and be lifted up then and set down by the surf. Every time it touched bottom it would give itself a push with its wheels and when it was waterborne, it would kick with its propeller.

Now there's a story of one event on this. A group had the Dukw down at Provincetown where they were going to make some tests unloading a Liberty Ship on the back beach. The Dukw was in a garage in Provincetown. A gale came up, a very rough sea with high winds, and a Coast Guard boat with seven men aboard was driven ashore on the back of the Cape, on the Peaked Hill bars. The sea was so rough that no one could get a boat out to reach them from the shore. A boat going out of Provincetown Harbor could not approach them from the sea because they were far in among the bars. At one o'clock in the morning, Putnam, knowing about this, roused his driver and got his Dukw out of the garage. They rolled out to the back beach -- and they went out to sea. They picked off the seven stranded men and brought them to shore. By morning their boat had broken up and vanished. [? NOTES: OBSCURE: EITHER THE DUKW HAD VANISHED? OR THE COAST GUARD BOAT?]

Now Putnam not only did this, but he didn't forget to rouse his photographer, too. The photographer managed to get some pictures of the show. When it was over (I unfortunately

- 1) WWII
- 2) THE DUKW RESCUE OPERATION AT PROVINCETOWN
- 3) PUTNAM HAS OPERATION PHOTOGRAPHED

missed things, I wasn't down there), I took one of these pictures and I went to see Henry Stimson. I told him the story and gave him the pictures.

Shortly thereafter, there was a cabinet meeting. And Stimson, after the cabinet meeting, went over to the President. Frank Knox, Secretary of the Navy was just passing and Stimson said to him, "Come over here Frank, I want to show you something." And he showed the pictures to the President and to Knox and ended up by saying, after he'd told the story, "I think this is probably the first time in history that a Naval vessel has been rescued by an Army truck."

* * *

Well, there were lots of interesting experiences with the Dukw. I was down on the shore, (I guess it was down below Norfolk somewhere) when Putnam put on some demonstrations for the Army. It was a very cold day, in November perhaps, and Putnam had the Dukw going up and down the beach. Some fifteen officers were there to see the show. He got them into the Dukw and started down the beach. I was aboard. A surf was rolling in, oh, perhaps three-and-a-half or four feet high as it broke. Putnam stood up in front of the crowd and said, "I'm sorry gentlemen, that we have no surf this morning. I'd hoped to show you how this craft operated in heavy surf. But the wind went down in the night and hence we have a light surf only. However, we'll show you what it will do in this light surf. You'll have to imagine what it does in really heavy surf. Driver, take her out to sea."

- 1) WWII -- DUKW
- 2) STIMSON REMARK TO FDR & KNOX "NAVAL VESSEL RESCUED BY ARMY TRUCK"
- 3) PUTNAM DEMONSTRATES DUKW FOR ARMY

The driver swung her over, she went through the surf and out to sea.

Of course, there was a good deal of spray and a few big splashes came aboard and it was pretty damned cold going.

When we were well out to sea Putnam gave the Army officers a little more lecture. Then he said, "One thing you should notice, gentlemen, is the way this craft behaves if it gets into a trough." Driver, put her up to trough at the sea." So the driver put her broadside to the seas not far out from where they were breaking. She rolled back and forth a bit, but it didn't do any harm. Putnam continued his lecture and after a while said, "Are there any questions?" There weren't any, so he said, "All right, driver, take her ashore." We went ashore through the surf and drove up toward headquarters. When they got there all the officers hopped out and beat it to the bar. Probably they needed a drink.

Well, this was Putnam's showmanship, it's true, but it was excellent showmanship. Nevertheless, the Army had not cottoned to the thing. When it was first proposed, as I've recited elsewhere, [X-REF BACK TO P. 409 & FORWARD TO P. 478] they wouldn't go along with it. General Somervell said, without any question, that they didn't want it and wouldn't use it.

It succeeded in spite of that opposition. It succeeded for two reasons. One, the news of these very startling demonstrations went around. A lot of officers knew about it and could think about what would happen if they could use it.

- 1) WWII
- 2) PUTNAM DEMONSTRATES
DUKW FOR ARMY AND
OVERCOMES STRONG
OPPOSITION TO IT

Second, the tests of it initially were carried on by Jake Devers who was then training an armored division somewhere out in the Middle West. [X-REF BACK TO P. 257 & FORWARD TO P. 763] With one thing and another, it caught on so that the Dukws were then manufactured and supplied to our forces and also to the British. They did a lot of good work out in the Far East. They particularly did well, as we know, in the Sicily landings; later, very important work at the Normandy landings when the surf was really tough.

- 1) WWII
- 2) INITIAL TESTS OF DUKW
CARRIED ON BY
JAKE DEVERS
- 3) PALMER PUTNAM

Putnam went out to the Pacific in connection with the Dukw and sat in on staff conferences in various theatres. I believe he went to seven theatres before he got home. On one occasion, in going from one theatre to another, he took a message orally from Lord Mountbatten to the British in another place. I think it's fairly extraordinary that an American civilian was employed in that capacity. He sat in on many plans and helped work out methods of getting ashore in the face of opposition, using the Dukw with rockets to bombard the shore. I have no doubt that he contributed when he did this, and that he really would have his facts in hand. He still lives on the Pacific Coast [EH SAYS: N.B.] [VB SAYS: I JUST WROTE EH ABOUT THIS] [AM to AM: SHOULD BE c. MIDDLE OF MAY OF '65] somewhere and it would be interesting to talk it all over with him again.

When he came back from his Pacific mission, he'd been gone for quite a while, he came into my office to report. As he started to talk he was swaying on his feet. I said to him,

"Put, how long since you've slept?" "Oh," he said, "not bad this time, perhaps thirty-six hours." I said, "Look, Putnam, you're worn out. You're highly nervous and you're not in good shape. Get out of here and take a bit of vacation somewhere and come back in a week; then I'll talk to you." I didn't see him for a month. He really folded when he got the tension off him. Then he came back all right, recovered.

- 1) WWII
- 2) PALMER PUTNAM

Putnam was one of the most interesting men of the war; I suppose a typically American go-getter. He would go in spite of all obstacles. He was very much liked by some of the military and very much disliked by others. With his own group I think he was popular. Although he was the man who usually appeared, when one gives Putnam credit for the Dukw or anything else, one has to remember that if he were consulted on that, he would promptly assert that it was the work of a group, and of a very interesting and tough group.

I've already told elsewhere [X-REF BACK TO P. 408-409 & FORWARD TO P. 727-728], I think, the story of getting the instructors to North Africa and I've also talked about [X-REF BACK TO PP. 174 & 409] Eisenhower's message to Marshall. So I won't repeat them here.

* * *

Question 92: Truman

You have here six items any one of which would take a good part of a reel to develop fully, but I'll label them with numbers individually and we may as well go ahead with some of them at least.

When Truman became President, just after Roosevelt died in Warm Springs, he was visited by Henry Stimson who told him that there existed, in development, a very important weapon. I don't think he told him much more than this except that I could tell him the full story. So I was called to the White House, sat down with Harry Truman and I told him the full story of the A-bomb as it then stood -- its power, its schedule and all of the rest of it. This was the first time Truman had ever heard of it. It was also the first time that I had ever seen Truman. I got on a good basis of exchange with him at that first session. Later on, he became very dependent on me, I think, at least for a while, for information on that sort of thing. We had an interesting relationship indeed.

I've told elsewhere about how this blew up after a bit and I may repeat some more of it. [X-REF BACK TO PP. 341-343 & FORWARD TO PP. 463-464] Let me say that I developed great respect for Truman. I saw him in action several times when he was a real statesman: I saw him display superb courage [X-REF BACK TO PP. 344-345], and I want to get that on the record. It undoubtedly will appear in quite a number of places. In regard to the briefing on the bomb, there wasn't

- 1) HARRY TRUMAN
- 2) BUSH BRIEFS TRUMAN
ON THE BOMB
- 3) BUSH ON TRUMAN

much to it. I simply told him the full story. I got out of it a few remarks that would be regarded as characteristic of Truman. [EH to VB: BUT PLEASE DON'T FORGET TO COME BACK TO TRUMAN's "CHARACTERISTIC REMARKS".] [VB to EH: UNPRINTABLE]

- 1) WWII
- 2) GENERAL STYER FORMS
MANHATTAN DISTRICT
- 3) BUSH BRIEFS STYER
ON THE BOMB

I might as well pause on this and tell about how I first told General Styer about the bomb. When I told Stimson that the progress on the bomb had reached the point where a very large amount of money had to be spent for manufacturing facilities and so forth, and suggested to him that the Army take over at that point -- that was when the Manhattan District was formed. Stimson put the job of forming it into the hands of General Styer, who was a very able general indeed. He was deputy to Somervell. Styer met with me and discussed it, then he came over to get posted on the thing. I said to him, "Well now, here, I've told you the general outlines of this affair, what the bomb is like and so forth, if it ever comes about. I think you ought to go over some of the records on it which I've gotten out of the safe for this purpose." I sat him down in an adjoining room to spend his time looking these over. And every little while I'd hear exclamations out of him -- profane exclamations, incidentally. Well, that was the sort of thing that I had got out of Truman when I went through my story. [EH to VB: THIS ANECDOTE HAS NO ENDING.] [VB to EH: This was typical whenever I briefed anyone -- first interest but skepticism, and also no doubt disbelief -- they would not really take in the significance. Then, as figures began to

sink in, surprise, then excitement. So with Styer. When he entered he evidently thought he was being given a fairy tale. As he read, every time I heard him swear or whistle, I knew he had seen light. At the end he came in bristling to get going.] [END WRITTEN INSERT]

- 1) WWII
- 2) TRUMAN'S COURAGE --
DECISION TO RELEASE
SMYTH REPORT (REPEAT)

* * *

The release of the Smyth report shows, I think, Truman at his best. I rather think that I recited this once. [X-REF BACK TO PP. 269-271] In fact, as you get these records together, I'll be surprised if you don't find the same story told two or three times in some instances because I'll be doggoned if I can remember whether I've touched a particular thing or not before I come to a specific question on it. However, I'll tell it very briefly again and then, if it isn't somewhere else, I can elaborate.

At the end of the war, Henry Smyth of Princeton was put to work getting a volume out in order to tell American Science all that could be told about the atomic energy affair in all its phases. His instructions were to put into that everything that would be helpful to American science in pursuing the subject further, but not to put in anything unless it was known to the Russians. Groves with his counter-espionage work knew, I think, pretty well what had been transmitted to the Russians, and he knew pretty well how it had been done. Under the conditions of the war, with Russia as an ally there wasn't a great deal that one could do if he came across such a trail

except to pinch off its source of information, whereupon it would merely turn elsewhere. But Groves was in on all the preliminaries of the Smyth report and went over the document with great care. Groves, Conant and I were all in the position of saying that this document, this book, contained nothing that the Russians didn't already know, but it contained a great deal that Americans didn't know. [X-REF BACK TO PP. 269-271]

We met in the President's office. Admiral Leahy, who of course knew nothing whatever about the subject, but could nevertheless be positively didactic about it, opposed the release. Groves and Conant and I spoke in favor of it. Truman went around the room and made each man express his opinion and his reasons carefully and fully. Then he simply sat back and thought a while and said, "I regret that I am in a position where I have to make decisions like this." And then after a bit more pause, he said, "You will release the document and the meeting is adjourned."

I respected him enormously after that and after many other incidents which showed that he was a real statesman. I remember one that I've mentioned in passing where he and Forrestal and I were talking about something (I think this was Forrestal) and Forrestal said something about the political implications of the decision. Truman said to him, "Look, when you take a thing as serious as this to the American public you should forget political considerations." I believe that was an honest statement and that's what he actually did when he was up against a tough affair.

- 1) WWII
- 2) TRUMAN'S COURAGE--
DECISION TO RELEASE
SMYTH REPORT (REPEAT)

[BRIEF PARAGRAPH CUT HERE ON TRUMAN'S CABINET MEETING
ON POLICY. EH to JK: BE ON WATCH AND NOTE. X-REF BACK TO
P. 463. ASK AGAIN]

- 1) WWII
- 2) REPEAT OF
TRUMAN LOSES
CONFIDENCE IN BUSH

The next item, however, reappointment as the Chairman of the Research Development Board does have to do with Truman; again it shows pretty clearly what kind of individual he was.

I had been Chairman of the Joint Research and Development Board which was planned to tie together the research activities of the Army and Navy, which was then rather informal. When the Unification Bill went through Congress, this board was made a formal organization in the new structure. Forrestal told me he wanted me to be chairman of it, and that the President wanted me to. I told him, "Jim, I'm afraid it's no go. Truman used to lean on me heavily and then in recent months I've never heard from him nor seen him, and there have been incidents which indicate that he's lost confidence in me."

Forrestal and I went to see the President, who said he wanted me to head the Board. [X-REF BACK TO 179, 341-343 & 461] I said, "Mr. President, I'm afraid that's no use. I think you used to have some confidence in me, but you've apparently lost it, because you haven't called on me for a long time." He swore at me and asked me how I got that fool idea in my head. "Well," I told him, "when President Roosevelt wanted a report on postwar science, he called on me. When you wanted a report on postwar science, you called on John Steelman." "Well but," he said, "you are a member of

Steelman's committee." I said, "Yes, I was a member of the committee but I never saw the report or any draft of the report until it was actually in print." I think this was thoroughly news to Truman. He swore some more, and said, "Never mind that, I have complete confidence in you." And so forth and so on. He finally said he was going to continue to call on me as he always had. I said, "Very well, Mr. President, I'll take the job." I went ahead with the job and Truman never called on me afterwards. I've always thought that somebody poisoned me because Truman listened to this sort of thing, unfortunately.

1) REPEAT OF TRUMAN
LOSES CONFIDENCE
IN BUSH

One time Clinton Anderson and I were talking and he mentioned something he thought I ought to take up with the President. [X-REF BACK TO PP. 341-342] I said, "It's no use, Clint, I haven't any standing at the White House now." And he said, "Why?" I said, "Well, I evidently got in the way of the palace guard and I got poisoned." He said, "You know that happened to me once. There were two or three months when the President wouldn't speak to me, and I've never found out why." Neither did I ever find out why.

I did, and I think I've recited this somewhere else, come to the conclusion later on that Truman found out that he had no basis for his feelings. For in his museum, out West, a friend of mine found my picture posted in a rather prominent place. But I'm not sure of it and I haven't seen Truman to ask him. [X-REF BACK TO P. 343 & AHEAD TO P. 741]

I'm pretty sure that Steelman had no use for me. He was an obscure scientist, and I don't know how he ever got on the staff of the President and he had no standing among scientists generally.

1) BUSH's OPINION OF
JOHN STEELMAN

One day I was in the White House because the President was going to pin a medal on me; Phoebe and I were waiting in the anteroom. The President was very annoyed with me just at that time, for a reason I can tell somewhere else having to do with the conferring of medals generally. [X-REF FORWARD TO P. 739] As we were waiting, John Steelman came in. We shook hands and "How are you, John?" "How are you, Van?" and so forth, and he went out the other door. Phoebe said to me, "Who was that?" And I said, "That was John Steelman." She said, "I thought you didn't like John Steelman." I said, "I don't and he hates my guts." "But," she said, "you greeted each other like old friends." And I said, "That's the custom of the town." It really was, as a matter of fact. [X-REF AHEAD TO P. 740.]

I don't know whether John Steelman was the guy that put something in the President's mind or not. I do know that Steelman had no standing among scientists and that when Truman leaned on him for his contact with science, he lost his contact with science. I don't think that it really got restored until Eisenhower got Jim Killian as his scientific adviser in 1957 after the Sputniks.

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Question 93: Bush Appraises Characters of Some Admirals and Generals

- 1) BUSH's OPINION OF GENERAL GROVES
- 2) ADMIRAL PURNELL
- 3) GENERAL STYER
- 4) CONFERENCES AT POLICY COMMITTEE OF NDRC

I've already commented on all nine men that there are listed here and there probably isn't a great deal to add on any of them beyond what I've already said.

General Groves was a strange individual and still is. I got along with him excellently after the first encounter which is recited in his book. [REFERENCE] We had good conferences at the policy committee. [X-REF BACK TO PP. 365, 424] Admiral Purnell was particularly helpful. I remember one instance where there was a question as to whether we were going to get Army ordnance or Navy ordnance into a particular affair. After we'd discussed it, Admiral Purnell said without any hesitancy that we ought to put it with Army ordnance because there was no doubt that they could do a better job.

General Styer of that group was also equally good. He was the fellow that Stimson depended on, and too Marshall, I judge, for the contact with the whole affair. Styer was an excellent sobering influence on Groves. Groves, in his presence, would not pull off anything queer, of course, so that those conferences were excellent.

I think that we held one every week, and decisions there were pretty broad. The things I got from Roosevelt were of course very broad authorizations. Usually on this basis, that I'd take him a report and there'd be a single sheet in the latter part of it of summary and recommendations, and his

"O'K' FDR" on that was all that was necessary for the broadest sort of moves. [EH to VB: THIS IS SO VAGUELY PHRASED THAT IT'S HARD TO KNOW WHAT'S BEING DISCUSSED.] [VB to EH: SEEMS CLEAR TO ME.]

- 1) "OK FDR"
- 2) BUSH ON ADMIRAL KING
- 3) ADMIRAL KING'S BLIND SPOT ON RADAR

* * *

In general I think Admiral King was quite a man, but he no doubt had a bad blind spot for new things. The most striking instance I witnessed was one time when he was talking to some young officers as they were looking over the designs of a new battleship. The whole craft bristled with radar and King said, "There's too much radar on this ship. We've got to be able to fight a ship with or without radar." [X-REF AHEAD TO P. 482.] This was just after we'd lost a couple of cruisers in the Pacific because the Japanese used their radar properly and we didn't. So he had a very bad blind spot. You'll find a great deal of this in Stimson's biography by McGeorge Bundy. [REFERENCE]

There was quite a contest there on the matter of convoying versus hunter-killer groups. The British were way ahead of us on hunter-killer groups. When I get to talking about submarine matters, as I undoubtedly will, I can tell you about an instance that was striking up on the Clyde where the British were far ahead of us on the hunter-killer business. They were rather contemptuous of us as a result, and they were quite justified. [X-REF FORWARD TO PP. 747-749]

King held rigidly to the idea that the only way to work

against the submarine was by the convoy method. Stimson contested this and it got to be quite a bitter sort of an affair. [X-REF AHEAD TO PP. 814-815] The trouble was that King thought he knew all the answers and he just didn't put one hunter-killer group in action to see what the results might be; he didn't follow the British actions, I'm sure, well enough. He stuck to his idea through thick and thin. And it happened to be the wrong idea. [EH to VB: AM I READING YOUR INTENT OK HERE?] [VB to EH: YES]

- 1) ADMIRAL KING's BLIND SPOT ABOUT RADAR
- 2) BUSH ON GENERAL HENRY

* * *

Bedell Smith, well, I've talked about him. I don't know that I recited the story about the very troublesome Britisher who tried to get one of our generals court-martialed for nothing whatever. Bedell Smith was in on that when I come to that story. That was General Moses, I believe, an excellent individual. [X-REF FORWARD TO P. 695]

Sometime also I want to say a word or two about one of the generals that I thought was one of the finest chaps of the war. This was General Henry [X-REF FORWARD TO P. 695] Let me say just one word or two about him. He had trained a division and when it was sent overseas, he was regarded as too old to go with it, which was quite a setback to the poor fellow. He was made head of G-1 on personnel and this was a pretty tough thing to do to him. Yet, he served loyally and without any complaint whatever. He had the WACs under his command, and I saw him one day going over some matters with

the head of the WACs, Mildred McAfee Horton. He treated her with the utmost Southern courtesy. He came from Louisiana. Yet there wasn't any question who was boss, what his orders were, and no question but what she was going to follow them out without any argument whatever. He was a marvelous fellow.

Six months before the end of the war he was diagnosed as having an intestinal cancer and told that he had to be operated on at once if he was to have a chance. He stuck to his post and finished the war. Then he went in for his operation and we all thought we'd seen the last of him. He not only survived the operation, but had no recurrence. He went back to Louisiana after the war. He visited me a few years later, erect, keen, just exactly the way I'd always known him. So that he was completely cured of his cancer as far as anybody could tell.

We need to do quite a little discussion, I think, about why it was that Ike and General Marshall failed to follow the technical developments. They most certainly did. [HK NOTES: DID FAIL, I PRESUME.] I don't think that Marshall ever once mentioned atomic energy to me except when I took him a report, for he was a member of the top policy committee. [X-REF BACK TO PP. 174-175, 410, 449]

Incidentally, so that we won't forget it, I want to tell the story sometime about Wallace on that committee and how he was dropped off the committee. [X-REF FORWARD TO P. 489] I also want to tell the story of the lost reports [X-REF AHEAD TO PP. 758-759] which is quite a story where the White House

- 1) BUSH ON GENERAL HENRY
- 2) REPEAT OF GENERAL MARSHALL & IKE FAIL TO FOLLOW TECHNICAL DEVELOPMENTS

lost one of mine and also one of General Marshall's.

Turning back to Ike and General Marshall, in the first place these men were both too busy to think of anything except the daily work. They had all sorts of tough decisions to make, an enormously complicated machine and quite naturally, therefore, they left the question of following new technical developments to others. [X-REF BACK TO PP. 174, 410 & 449] This would account for it all but I think there's another point here. Both of these men had been trained all of their lives on strategy and tactics. The new weapons such as the proximity fuze were going to change this whole picture. It's very hard indeed for a professional man who has thoroughly learned his business suddenly to turn around and learn a new act. I've seen it with professors, oh, Professor Laws at MIT, who at one time was about tops in the field of electrical measurements. He just did not know anything about the thermionic tube, was too old to learn about it and when it came along, he suddenly became out of date. And so it was with some of the military men. Some of the tendency to fight a war with weapons of the previous wars goes back to this fact. I think both Ike and Marshall were subject to this affair. It's excusable although regrettable.

On the other hand, there's no doubt that Stimson was busy. He was older than either of these men, considerable so. Moreover he, as a lawyer, was further removed from the technical.

1) REPEAT OF
IKE & GENERAL MARSHALL
FAIL TO FOLLOW
TECHNICAL DEVELOPMENTS

Yet he had a keen interest. He had such a keen interest that it was sometimes embarrassing. I can tell the story of the smoke generator and how he grasped [?] it until he got me into trouble. [X-REF FORWARD TO PP. 759-760] I can tell the story of the radar when he first learned what it could do and got very excited. [X-REF FORWARD TO PP. 760-762] He was an extraordinary individual.

He ran the War Department, principally, by bursts of righteous indignation. [X-REF AHEAD TO P. 714] When he was on the warpath, the generals got under their desks. Marshall, one time when I was talking with him, was called in by the Secretary rather abruptly and I take it on a minor matter. When he got back, he said a few words about the fact that the Secretary treated him more or less like an office boy at times or something of the sort. Not with any bitterness, but merely as a casual remark. On the other hand, I think Marshall and Stimson worked together excellently. I have no doubt about that whatever.

Now we're getting pretty close to the end of this film and I think there's very little more that I can say. It's hardly worthwhile carrying over onto another film.

I've said something about Tony McAuliffe, I'd like to say one or two more things at some time because he was an extraordinarily likable individual. He helped smooth the way by knowing the scientists and the military men and being somewhat of an intermediary at times. [X-REF BACK TO P. 257]

- 1) BUSH ON STIMSON
- 2) BUSH ON
TONY MCAULIFFE

Reel 7-B
Page 471-A

As far as this business of not being alert to the new developments, I ought to tell the story about the Navy at the beginning of the war, when they needed no help on submarines because they had the matter licked. So in this particular comment here there's room for quite a few more questions.

[X-REF FORWARD TO P. 745]

- 1) WWII
- 2) NAVY DISDAINS HELP
ON SUBMARINE PROBLEM