

ECONOMIC INTELLIGENCE

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GENERAL ARMSTRONG:

Gentlemen, the fact that this morning we have a member of the Department of Political Science at Amherst College is particularly gratifying to the Industrial College. We are convinced that the political scientists must think more and pay more attention to the facts of war than they have in the past. Just recently at a meeting of political scientists there was considerable evidence that many of the more aged political scientists still resist any adequate thinking on their part on the problems of war and peace. But in my opinion the contribution that the political scientists can make to the solution of the problems that face us is very great. For that reason we are particularly glad to welcome a member of the Department of Political Science of one of America's best colleges here this morning.

Professor Pettee comes to us with a very interesting and unusual background. He was employed in the Stockpiling Branch of OPM and WPB, where he dealt with strategic materials. He was Chief of the European Enemy Division of EEA, where he was engaged in collecting data on Germany and other enemy states. He therefore knows the methods of economic intelligence. It is a privilege to present to you this morning Professor George S. Pettee, of Amherst.

PROFESSOR PETTEE:

Thank you very much, General.

The introduction by General Armstrong makes me feel a little bit like a new Cadillac in a show window. On the other hand, I certainly would not deny to anyone that Amherst is one of our best colleges. I might add that Amherst political scientists might be expected to remember that soldiers are important, because they sing about a soldier of the king on every possible excuse.

Your obvious question will be, What has economic intelligence to do with industrial mobilization? I have always felt that the question, "So what?" ought to be written in letters of gold ten feet high behind the speaker's platform in every lecture room. I hope when I get through talking, you will not think that that question has gone unanswered, or at least that I have not tried to answer it even if it has gone unanswered.

My feeling on that is more or less expressed by one of Mr. Baruch's remarks a few months ago when he said that "production is the Law and the Prophets." I think production is a horribly important thing to understand either in war or in peace. Production is the key to how much labor deserves, it is the key to how much labor can get without inflation, the key to whether we are going to have inflation, the key to whether we

can pay off the national debt or maintain the national debt, or anything else. It certainly is the key to what the next war will be like if there is one.

Now, whether you people remain procurement officers or whatever you are, whether there is another war or not, you are going to be doing something. You are going to be doing something that is something similar to the level you are on now or on a higher level. Whether there is peace or whether peace is so secure that there is no U.S. Army, or whether peace is so insecure that there absolutely is a U.S. Army, or whether there is a world war or not, production is going to be a thing that we must understand better than anybody has understood it as yet.

I think in order to understand it better than anybody ever has to date, a combination of two subjects of study is very important. One is our own war production program in this last war,--how we did it, what worked and what did not work, what the successes were and what the failures were, and so on.

For the second in priority I would give you the German war economy. I give you the German because the British and the Japanese were not big enough to include all the problems. And I give you the German rather than the Russian because we know something about the German. To the best of my knowledge -- perhaps some of you could contradict me -- we do not know much about the Russian. Also I do not think we are going to know much about the Russian. Stalin put a few figures in his February speech. There was an article in the Economic Review trying to pin him down on the overall financial figures. There have been a few other things like that. But generally I do not think we know the Russian picture.

I had a job in economic intelligence for a matter of two years -- from the spring of 1943 until post V-Day. Economic intelligence is set up with certain limited objectives. Those limited objectives to some degree count in our evaluation; so I will mention them.

First, we wanted to find out how to hurt the enemy more effectively through blockade, through the cutting off of things like Iberian tungsten, Turkish chrome, Swedish iron and bearings, Swiss shell fuses, and so on. The thing was played up fairly heavily and we got fairly good publicity. Actually the pay off did not come until the spring of 1944, when through trade agreements with Spain, Portugal, Sweden, and Switzerland we really got somewhere near to closing down the German trade of those nations.

Secondly, we were in the business of picking bombing targets. In that connection we were supposed to analyze the anatomy of the economy of the enemy in terms of what was most essential to their war effort, what were substitutable and what are non-substitutable, where the bottle-necks were, how long the pipe line was between a given target and the front lines in action, the vulnerability of the target in all kinds of terms, from what will happen to a brick wall or a cement wall if a bomb of a given size bursts at a given distance, how many fires will be lighted with a 3-pound bomb, a 30-pound bomb, a 100-pound bomb, and so on. In the course of that work prime targets were chosen. They were worked on by the

BEW, the FEA, the OSS, and the British agencies. The prime targets chosen were aircraft, bearings, oil, rubber, and transport.

I don't think anybody would brag about that work. Those of you who are familiar with the Strategic Bombing Survey studies know how frequently they indicate that some of our target selection was not too good; and the fact that there were targets, very good targets, that we did not pick. I certainly am in no position to defend the work on that, because I was not in that phase and had nothing to do with it.

Thirdly, we wanted occasionally to judge the economic effect of ground actions as indications of enemy strategy. When we were about to go into Sicily, we were all under high pressure to estimate the effect of the blocking off of Sicily from the enemy - the loss of their sulphur, olive oil, tomato paste, and a few other things. We were supposed to estimate the significance of those losses as an index of how the enemy would act about the threat. Would they defend Sicily seriously because it was worth a lot to them, or would they defend it only in terms of a dilatory action? We thought that sulphur was important. We learned after the war that the sulphur was not important, which took some of the glory from our work.

Another fair sample was this: We thought Rumania was important. Rumania was important. I think any of you or any of the girls in this building could have guessed right on that one.

For another sample, we thought Nikopol was important. There I think it is fair to say that the Germans took genuine military risks and hung on to Nikopol for a matter of weeks longer than they might have, because manganese was really important.

The fourth excuse for our existence was to judge enemy capabilities and intentions for the Joint Intelligence Committee, working for the Joint Chiefs of Staff. The Joint Intelligence Committee prepared regular periodical estimates of enemy capabilities and intentions for the next so many months and so on. We and some other agencies had a hand in preparing those estimates.

Finally there was the matter of occupation problems, on which, of course, anyone that knew the enemy economy could predict a good many of the problems that would be encountered.

The judging of enemy capabilities and intentions was, I think, the key problem. The strength of the enemy is in one way or another one of the key premises on which all our own war planning is based. How many guns will we need, how many shells, how many aircraft, how many landing barges, and what have you, - all these depend on estimates of enemy strength.

Now, I say this in spite of the fact that often estimates of enemy strength seem to be ignored and that there were many occasions when the high command in the course of the war ignored certain conclusions of

intelligence because they just did not trust them. But even if they decided, because of this, to reject the data of the enemy's strength in certain respects, to overlook it, and simply to allow a terrific safety factor so that we would snow them under, it is none the less a matter in which some kind of guess on enemy strength is there. And if you really worked out the procedure logically, you could not do it without an X for enemy strength as a part of the logic of determining our own war requirements.

If that X is vague, if it is treated purely as an unknown because you do not trust your intelligence, your own war plan is more wasteful, more vague, more by rule of thumb, and more subject to all kinds of surprises.

Now, the most glaring thing about the German war economy is also the most glaring thing about any national economy or war economy in the last considerable period; and that is the contrast between the picture in our minds and the picture of the real facts as gathered by the Monday morning quarterbacks. Our consciousness at the time, our contemporary consciousness of the German war economy, was altogether different from the German war economy as we can see it now.

Now, when a thing like that occurs, the hiatus between the mind and the action at the time of action, there is a tendency to think afterward that, "Oh, well, now; we know the German war production was bigger than we thought it was. So we changed the thing in our files. We recognized it to be so many planes, so many tanks, so many guns in 1943 and 1944. So we corrected our mistakes."

I want to hand a big question mark on that kind of correction. I do not know how you correct the mistake until you supply the apparatus of thought which will enable you to guess right next time. That kind of hindsight very frequently fails completely to re-equip your mind to guess right the next time.

Now, that comes close to being a problem in semantics or something. I do not want to go into the philosophy or the psychology of the doctrine or anything of the sort. But I do want to hammer at the point that we were wrong in most of our guesses about any war economy. Not we alone were wrong. The Germans were wrong about the Russian and the American war economy, and the British were wrong about the German. The Russians were wrong about I do not know how many, probably ours. The Japs were wrong about everybody's war economy.

It is a monumental fact that we were wrong about our own war economy until after Pearl Harbor. We did not know what we could do. We did not plan to do what we could do. Roosevelt is on record as saying that we could shoot the moon with ten billion dollars of total war production, total war effort -- with the first ten billion dollars.

Well, I want to recapitulate approximately what we thought of the Germans before June, 1940, because I want to hammer at the German as

being the example of a war economy nearest to our own and the one that is therefore very important, because any two are better than any one. It is like trying to tell a stranger on this planet what an automobile is by showing him only a Cadillac or only a Ford. He would have a better idea of an automobile if you showed him both, not one or the other. I don't mean that one of these is a Cadillac and the other a Ford, but that any two war economies illustrate far better than any one what is essential and what is incidental in a war economy.

Before June, 1940, we thought that the German war economy was based on the principle of cannon instead of butter. Goering said so, though he did not illustrate it very well in his person. We thought also that it was mostly based on the fact that the Nazis were horrible liars, and we thought that the war estimates going out could not be right because Sir John Simon knew that a war economy on a good, sound financing in a rich country will support a bigger war than cockeyed financing in a poor country. That is obvious. Obviously Britain could out-produce Germany on that kind of thing.

We thought that all the German tanks broke down on the way to Vienna when they occupied Austria; that Schacht's finance was all phoney finance and would not operate; that Germany would have inflation in no time at all. It was just around the corner -- a general financial breakdown and collapse. The blockade would be effective within a year or so, because the Germans could not along without oil and they had no oil. Their other strategic and critical materials were all short and would not last more than another six months. Then they would be all washed up. There was industrial sabotage. The bombs dropped by Germany in France and Spain had little chits inside them saying, "Here's one that won't go off, comrade." Most German bombs would be duds, because of the disloyal German underground. The German railroads, believe it or not, were on the brink of a breakdown; and the evidence for that was that they were carrying more ton-miles than they ever carried before. Well, all that added up in the winter of the "phoney war" to that phoney picture of the German economy.

Now, I have not made this up. I can document it if anybody wants it documented. But I shall not spend time now doing it. That is what people outside Germany thought of the German economy at that time.

Then France fell in June, 1940. Immediately we changed a few of the signs. We said they were a totalitarian system and up to all kinds of unconventional economy. But - oh Heavens! - it turned out that that meant they were efficient, not inefficient.

Being totalitarian, obviously they were up to the ceiling. They had everything up to the ceiling early. As late as 1942 in our intelligence agencies there were reports that they had completely rationalized German industry in 1941. There wasn't any more rationalizing to be done after 1941 in German industry.

By 1943, since there had begun to be some bombing and the labor situation was a little tighter than it had been before, German war

production was declining as against 1942. It was 10 per cent for bomb damage and down 3 per cent for the decline in productivity of labor because of the drafting of skilled workers and using ignorant housewives, school teachers, and foreigners, who obviously could not produce so much. That, incidentally, is why we could not build any B17's or B29's or Liberty ships in this country -- because the labor was no good.

That is again a matter I can document if anybody wants it -- that by our estimate the German war production was down 3 per cent, not 2 or 4, for the declining productivity of labor. Well, now, obviously the minds that were working on the subject could not know much about a war economy.

It might be that there was just a left-over, submarginal Ph.D. working in OSS and FEA and that all the really good men and engineers who knew production -- they didn't know a lot of economics -- were in the Army or Navy procurement or in War Production; that actually we had a corps of people in this country with sound doctrine on war production, and the absence of a sound potential in the intelligence agencies is no evidence that we are in a bad way mentally.

I do not think that is so. Some people in these economic intelligence agencies had served their time in the War Production Board before they transferred into economic intelligence work. If they had not learned any war production, then it was not in the War Production Board as a doctrine that you could not miss if you worked there. If a bright fellow could work in the War Production Board for a year and then move into economic intelligence work and show that he knew nothing about war production, then there was not in the War Production Board a doctrine that people could not miss picking up.

I would say in general that on the record we did not have a doctrine on war production that really added up so it made sense, that everybody could understand, and that could be taught and could be learned so that the student would show his understanding of it six months after he went into a new kind of work. I would say that is the thing we can't get along without in future students, whether in peace or war, because war production is after all production, and we must understand production.

Well, now, what was really going on in the German war economy? I gather you know something of Germany, and I do not want to spend time telling you things you already know -- about how they operated their allocations and priority systems, what their rings did and what their main committees did and so on and so forth, what Speer did organizationally after he started trying to go to town.

But I do want hammer at one general thing. The German war effort before the fall of France was so big that it was incredible to us when France fell. That work "incredible" occurs in every testimony on the subject. Roosevelt in a speech down here in Virginia told everybody it was incredible. That is one reason we thought they were up to the ceiling. A totalitarian system turned out to be a system that must be as high as it can get.

I think in retrospect that the German war production before Pearl Harbor was never more than 30 or 40 per cent of a genuine war effort. Therefore, if it looked like the Chrysler Building from where we were, from where we were thinking before Pearl Harbor, and before the fall of France particularly, we had to break our necks they were so high up. Now, "high up" -- you need not be on the ceiling to be high up. You can break your neck by looking at the Chrysler Building if you are close to it, and the fall of France made us feel close to it. Thirty or forty per cent of a real, total war effort was high enough then to be incredible.

Then Pearl Harbor set us off and we really tore into things. We never realized that we had passed the Germans and left them standing, and that by the summer of 1942 we had a far more highly organized, for more totalitarian, war effort than they did. Our system of L orders, P orders, M orders, and the rest of the complex war controls in this country, which were worked out in the winter of 1941-42, predominantly and more or less completely in the spring after Pearl Harbor, was far ahead of anything the Germans had at that time.

Now, I can remember when I first began to suspect this, because I ran into the fact in the summer of 1943 that the Germans had decided to cut out the allowance of steel for making thumb tacks and paper clips. I called someone in War Production and asked, "When did we cut out steel for thumb tacks and paper clips?" They said, "That was in M-umpteen revised in June, 1942." The Germans got around to it a year after we did, not a year before or two or three years before, but a year after. Along in 1944 they cut out steel for coat hangers, which we had cut out in 1942.

Well, now, one of the clearest things in the history of ideas on this business which I know of, one of the things that shows the way the thing was going, was an assignment I gave a boy who was twenty-four years old and had had a few years of graduate work in history, but who did not yet have his degree. He was twenty-four and he was in history, not economics, and he did not know any economics, and he had never been near the War Production Board, and so on. I told him to dive into the German war production control system and see where he could get. He spent three months and came up with, "They only had half a system until after Pearl Harbor. Now they are beginning to really get somewhere."

It was after Pearl Harbor that they learned that they had twelve months of shooting war against twelve months production, instead of six weeks of shooting war against twelve months production. Would it not really have been incredible if they had really had an all-out system when they only had six weeks shooting? Germany would have been covered with warehouses, which our air forces couldn't have missed.

They filled their warehouses time after time. As late as September, 1941, they cut back their whole war production program because the warehouses were full and there was no prospect of cleaning them out in Russia. The Russian campaign would be over soon; they did not need the stuff, and so on.

Well, there was Pearl Harbor. That was probably an important date for them as for us. It was a starting date, because, as you remember, that first week -- I don't know which day it was -- the seventh of December for us; somewhere between the first and the tenth of December for them -- that was when they knew they would not take Moscow and that they had a shooting war that would last more than six weeks, that would presumably last all the next year. And they knew that America was in the war and that the shooting war would go on for a long time now.

So then they knew that they had twelve months expenditure to make, at least, with the then condition of the war economy, and began to think that the demand for the expenditure of expendables would be insatiable and that the condition of the economy and minimum inventories throughout the system would begin to be the standard, as the Russians had understood when they were getting planes away from the factory within half an hour and flying them to the front, and when they did not finish the outside of cannon because it was the inside that killed the Germans.

The Germans did not learn such things until we did, and they got the same transition date between a half-baked effort and an all-out effort that we did; and they were not a total war economy before Pearl Harbor by any manner of means.

When that time came, they also started more slowly than we did. They did not really make up their minds so fast as we did. Pearl Harbor was a godsend to us, far more than to them. It was notice that we really had to raise our sights and go all out.

Stalingrad reinforced the lesson for them. That was a whole year later. The landings in Africa, the battle in Sicily -- it was not until the actual landing in Normandy and the breakout from Normandy that they finally went to extreme lengths and began to employ their system vigorously, as we did just after Pearl Harbor.

I can remember the experts in my staff and the experts in other staffs who sneered and laughed at the German total mobilization in September, 1944, because they went back and counted and found that that was the fifth or sixth total mobilization in Germany. That obviously could not be possible. Actually that again reveals the hiatus between the mind and the fact. The first total mobilization that the Germans had was the fifth, not the first. The last one was the genuine one, not the first one. That is interesting to note about Germany and Naziism and about war economies.

In the course of tightening up they used all the methods we did -- standardization, concentration of nonessential industries in a few producers, equalization of plant efficiency, dispersion of targets, M-orders, L-orders, labor allocation, materials allocation. To some degree they had some reversion to 1918 warfare, which I think was an important feature -- the utilization of their economy for the maximum amount of war and a fighting war. They did more shooting of ordinary ammunition in 1944 and less burning of gasoline in proportion. Less frills and more plain shooting in 1944.

They got their richest logistics saving in the course of the retreat from Stalingrad. A ton of shells fired at the Russians at Warsaw required one thousand less ton miles added to the price of the shells than a ton of shells fired at Stalingrad.

They also finally got around to freezing series, instead of having a different type every five numbers and putting a new revolutionary ash tray on every third tank. They finally froze the series and got out the production.

There is one thing that I think was probably important in their war effort that has not been played up. It is the thing that was neglected in the Strategic Bombing Survey Study. This gives one little paragraph, about five lines, to the fact that the Germans tried to improve the efficiency of labor here and there. The German program labor efficiency was actually comparable to our own in all respects. It doubled and redoubled. There were training and time-motion studies. They redesigned things like light machine guns until nearly all parts were pressed and there was almost no machining.

Their glory stories, little ones, big ones, middle-sized ones, in this case prove that the German industrial picture was just exactly like our. Centrifugal castings of cannon barrels as against drillings to save big facing jobs. Every kind of simplification and redesign. They did not get around to machine drilling their diamond wire-drawing dies, but they deskilled labor as we did.

I think that is a key factor, one of the things that comes out most clearly in both systems and especially when you compare both systems, because, as I presume you know, the German index of munitions production went up 200 per cent after Pearl Harbor from their base months of January and February, 1942, to their high in 1944. It trebled; went up 200 per cent, on an increase in labor of 20 or 25 per cent and an increase in materials approximately the same.

The difference is value added by manufacturing, in statistical terms. They added enormously to the value of the finished munitions, and the biggest factor in production and the biggest influence in that is the quantity of labor multiplied by the skill of the labor. They managed the skill of that labor marvelously, partly by machine redesign and partly by training the workers, breaking down the job so they had to train the worker on only one little thing, thus reducing the training to a week instead of a year's apprenticeship.

The general effect I suppose you know. They increased tank production six times from 1942 to 1944. They doubled or tripled aircraft production in the spring of 1944, after our "Big Week" when we knocked out all their aircraft production. They produced more planes in March than in February, although the "Big Week" was the last week in February.

There again I can give you an illustration of the history of ideas, because I had three boys working on that who were in their early twenties.

They went over the picture just after the big week with some people in another agency. Another agency gave the Germans three hundred planes a month in March and six hundred in June. My boys gave them six hundred in March and a thousand in June. The Germans produced two thousand in June. My boys missed by a hundred per cent in their figures, but they came a great deal closer than anybody else did.

Now, why was that? Because some plants that the Air Force had bombed were being repaired in a hurry. Others were not being repaired after they were bombed in that big week. Other agencies said, "They haven't enough repair facilities to go around. The ones they repair will come into production soon. The ones they don't repair will not come into production." My boys said, "The ones that are not repaired were ready for dispersal. They are being dispersed and they will be in production before the ones that they are repairing."

The youngsters had clearer heads and did not know so many things that weren't so. Just as the boy who did the job on German war controls was the first person in this town, I think, who said the Germans did not have a wonderful war control system before Pearl Harbor. These boys got the fact because they could look at it straight and see what it was and not be blinded by the fact that it was Nazi and totalitarian and therefore up to the ceiling and unable to go anywhere but down. They could see it straight. These youngsters I had, who could imagine that the Germans were dispersing a plant that they would not repair instead of waiting for the repair men to get around to it, did much better guessing than the people who thought, "Oh, they are all tied up and they haven't enough labor to go around. They can't repair them all at once."

Well, when a bright young man can outguess a Ph.D., it is a clear illustration that the old doctrine is not good. Something is wrong with it. It is also a clear illustration that the problem is not impossible; that you can work out solutions and you can develop a doctrine if you go at it right, if you can see your way right with the development of new methods.

I fear I am talking somewhat longer than I ought, but I will spend a few minutes with you before we open up the questions trying to tell you briefly what I think we have to learn from all this, although I have demonstrated it to some extent as I went along.

First, I think one thing we can learn is to hang a question on anything that is called a critical item. There are all kinds of things that are indispensable in war, such as ball bearing for radial aircraft engines. We bombed German bearings very thoroughly, and in the judgment of the Bombing Survey this had no significant effect on German war production.

Now, I do not mean that that bombing was wasted. It was part of the air battle over Germany in which we beat the Luftwaffe. But at least we could have fought an air battle without pretending to the boys that we had picked the most significant targets at the heart of the German economy. I have a lot of boys from the 8th and 15th Air Forces in my classes now and they are somewhat distressed at that. They are distressed

about what some of their prime targets really were; and I have to explain to them how we made those mistakes, how we might have done better; but also how those mistakes were not as bad as they looked.

We thought the Germans could not get along without ferro-alloys. I can remember a report which was the basis of spending millions of dollars in Spain to buying tungsten so that the Germans could not get it, and enormous diplomatic pressure on Spain and Portugal and Turkey to stop their chrome and tungsten supplies; and this report said that the German steel industry was going out of business in the fall of 1944 because those ferro-alloys had been cut off in the spring of 1944.

Well, the boys who got into Deutsche Edelstahlwerke found stacks of every ferro-alloy on the shelves in the spring of 1945. That is partly because we knocked out their transport, coal, steel, and everything, to such an extent that they could not use up the supply they had. Their whole economy began to fall all at once, all coincidentally, and the ferro-alloys which would have supplied them were left over.

The Germans got along on a fraction of the amount of ferro-alloys that we thought they had to have. I can remember when the British thought the Germans had to have seven thousand tons of tungsten a year and could not get along with a pound less, including several thousand tons for carbide cores for armor-piercing ammunition.

I fought that one myself. I do not mean to stand up and say that I **always** guessed right. But the best guesses I can remember were guesses where I guessed right. There are thousands of guesses in the history of war intelligence, the economic intelligence effort, during the war, and there are all kinds, good, bad, and indifferent. I guessed right that the Germans did not need tungsten for those carbide cores for armor-piercing ammunition; that they could use the 88 instead and an ordinary shell and puncture any armor of ours that they came up against instead of trying to puncture six inches of steel with a 37-millimeter shell or a super-duper shell. But my shop did do bad guessing generally about ferro-alloys.

Secondly, we can guess much better after studying both these economies on the problem of allocation to planes, or air power versus guns. There are always problems like that in any war economy. One of the things the Germans failed worst on was in getting judges into superior positions vis a vis parties. Claimant agencies were not put in a position where they had to take the consequences of the over-all judgment. The German air forces was not made a claimant agency until June, 1944. Some of the other agencies were not just claimant agencies until after Speer's control put them under control. They operated directly through procurement.

The toughest problem in any war economy, the biggest fights in our own war economy, were between various claimants. Unless you have a doctrine you can never satisfy a claimant that your judge knows what he is talking about when he knifes one item in favor of another. The Germans would have been better off if Speer had been strong enough to cut the air production, plane production, in 1944 in half, because they could not use the planes they produced to any effect. They would have been better off with more ammunition and less air power.

There were many occasions in our own production program when we fought things out between barges, escort vessels, armor, ammunition, and what have you. In all those cases it came down to pressure politics in war production. The German war economy is at least as good as if not a better illustration of the weakness resulting, in any war economy, from pressure politics between claimants and of the resistance to a rational choice of the over-all pattern of production, which would permit the greatest fighting based on the national economy.

Thirdly, we can consider the relation of the munitions supply to any such concept of the national income or gross national production and the civilian supply. I think we can learn a great deal from the German economy, particularly in respect to the fact that with gross national production moving very little, munitions production could triple, although munitions production is itself a pretty big fraction of gross national production.

Now, the answer there is that by taking a little out of the civilian supply, you can get more than the equivalent in munitions. There are question marks there in the terms of price of munitions. I do not know whether munitions prices are a solid statistical basis. Only through a close study of more than one war economy could we satisfy ourselves as to the real significance of some of these tape measures that we try to use in analyzing the anatomy of the war economy over all. Questions depend on them in any one, and unless we analyze more than one war economy, we cannot begin to figure out where the difference is and what the real significance was.

And we must know how far munitions production is exaggerated when we resort to uniform dollar prices in a general munitions index or uniform Reichsmark prices for German munitions, and how to use a thing like a munitions index, a thing that we must use, and to use it without hoodwinking ourselves because we understand its meaning and figure out how to use it without hoodwinking ourselves.

Fourthly, I think that the extraordinary importance of labor efficiency in a war economy comes out far more clearly when we study several than when we study any one.

Fifth is the general morale of the country in relation to the war effort. There, curiously enough, I think our own mythology had a big grain of truth in it. We claimed that a democracy could produce for war better than a totalitarian system.

Now, I will say that, given Pearl Harbor or something like that, a democracy very well did. We got pressures beaten down more than the Germans did. We got the resistances to efficiency beaten down more than the Germans did. We got the resistances within the processes, and politicians and congressmen, more submissive to the necessities of a war economy than the Gauleiters of the Nazi economy were to the necessities of the German war economy.

That is worth thinking about, because it is one of the taken-for-granted premises of our war economy unless we can minimize the need for a Pearl Harbor which is basic to the whole hypothetical proposition of another war for us, and learn how to run the war mechanism just as well or better without Pearl Harbors. I am not sure that that can be done.

Now, sixth, we face the problem of how to measure the potential scale of an economy in relation to future time allowances. If we are back just five years from reaching the peak of effort, we can use more capital investment than if we have to reach the peak in two years. The Germans were up against that question in relation to basic raw material supplies. They could have used more capital if they had had more material, and so on.

Seventh, the scale of war, which had us all hoodwinked. I don't think any of us have yet got our heads completely clear from the fog of war on just how big was the Russian war in 1941, just how big was the German war, just how big was the western war in 1944, and things like that.

There is one very interesting illustration of the nature of that factor in the bombing survey studies. These assert that during the entire French campaign of 1940 the Nazi army lost about one seventh as much equipment as during the single month of July, 1944 -- one seventh. We thought the Battle of France was pretty big when it happened. It was about one seventh as big as the fighting in the month of July, 1944.

The war went up an incredible degree in two stages, in our minds. 1940 was far bigger than we thought was possible, but it was tiny in comparison to 1944. The decimal point moved forward twice in our prewar concept. I don't think our prewar concepts have been completely re-coordinated.

Eighth, there is the question of what ratio of expending expendibles is appropriate in relation to the production of expendibles. The Bombing Survey studies criticized the Germans for not getting more divisions in their army. They needed more troops. On the other hand, unless I am wrong, I believe we boast that an American division could take on more than a German division; that twenty American divisions could fight more than twenty German divisions.

Possibly we did better by loading up real fire power in a smaller number of divisions than they did. Possibly they had too many divisions at the 1940 scale of armament and would have been better off if they had put more men back in the factories, with fewer of them shooting higher-powered guns. They never had as much artillery as we had per division. They might have done better with fewer divisions using all the artillery that they had and spreading that some artillery over a smaller army. There is always that question of what is the appropriate relationship of combat troops to the factories; and only, I think, by comparing two war economies do you begin to get any sense of the realm of choice involved in that particular problem.

It arises perhaps more clearly in connection with air power, where we devised an air force which could carry two and a half million tons of bombs five hundred miles and drop them; and by hindsight about half a million tons of these bombs had any effect of the war. Well, we might have done more to hurt the Germans with material going into those other two million tons of bombs than we did with them. It is at least a question.

Then finally I think that the fundamental lesson that can be studied in two war economies and not in one is how to comb out our brains, how to learn to think, how to devise a theory of a war economy which won't look foolish when applied to a war economy, an unpredicted war economy, which will close the gap between intentions and consequences, so that when we plan something and then act on the plan, the consequences of the action have pretty good conformity with the intention; close the gap between the intentions and the consequences.

We must learn how to hire brains, organized brains, and to manage and direct brains in a thing like a war production board or in a thing like an enemy economic intelligence outfit in such a way that the product of the group brain work is like the product of the group brain work in the Manhattan Project, where it had been shown that a lot of brains can be organized so they look more like Notre Dame on a good day and less like a high school team on a bad day.

We have a lot of thinking to do about the peace economy or the war economy. I believe that much of the thinking must be the same kind of thinking -- to learn how to run production in peace or production in war.

There is one thing on which I do definitely feel just what General Armstrong has ascribed to me. I feel that political scientists and economists should study war more closely. And I do feel this a rare opportunity -- to talk to some people who already feel that way and who are studying war economies.

GENERAL ARMSTRONG:

Gentlemen, I want to say that Professor Pettee has certainly proved the point of my preliminary remarks, that what we need is a greater interest on the part of political scientists. If one tenth of one per cent of the political scientists in the United States could make as constructive a contribution to our thinking and analysis as Professor Pettee has done here this morning, I think we could be secure in the next war. I want to say that the talk that we have heard from him is one of the most effective that have been presented to the Industrial College.

I have asked Professor Pettee, because I thought we ought to hear much more from him before he goes back to Amherst to sing that song about a soldier of the king, and he has agreed to be with us again at one o'clock this afternoon, when we shall have another session.

(( A recess was taken until 1 o'clock p.m.))

GENERAL ARMSTRONG:

Gentlemen, the target is up.

PROFESSOR PETTEE:

I gather that this is to be the question period that I tried to talk you out of this morning. Go ahead and fire.

A STUDENT:

I don't think we in the Air Forces contributed very much to intelligence, but I wonder if I missed your point when you were talking about ball bearings. Did you imply that they were not a target?

PROFESSOR PETTEE:

They certainly were a target. The Air Forces went after them and they hit them. What I implied was that they were an ill-chosen target.

The Air Forces didn't choose the targets. I certainly didn't mean to criticize them. What I mean to imply is that the selection of targets was made by a queer complex of agencies, including the FEA, A-2, and the proper British people, all working in interdepartmental and intergovernmental complexity. Much of the target work was not well done. That is certainly no aspersion on the Air Forces.

A STUDENT:

When you say they were an ill-chosen target, what do you mean by that? Do you mean that the planes didn't destroy them or that the Germans had all the ball bearings that they needed?

PROFESSOR PETTEE:

Much more the latter. We hit the factories. The shortage of ball bearings caused by hitting the factories was vastly less than anticipated, and the indispensability of bearings was much less than anticipated also. So what shortage was caused had less effect on war production than we expected would be caused by the bombing. Although the bombing was a bad piece of strategic bombing. It had nowhere near the effect that we anticipated. That is not the fault of the Air Forces in any way.

Incidentally, it is not the final judgment on the value of those raids, because the raids in 1943 and early 1944 were not only strategic bombing raids, but also raids in the air battle which beat the Luftwaffe. We would have had to conduct some kind of raids against something that they would defend, in order to bring the Luftwaffe to battle and defeat them anyway.

The final judgment of just what we should have been bombing at that time is complex. I think it is clear from the strategic bombing survey studies that we could have picked better targets than bearings. Electric power, for one, would have been a much better target. I think we could have accomplished a successful air battle without placing bombs on bad targets. I do think there was bad target selection.

A STUDENT:

Did the Air Forces accomplish anything in the bombing of the Ploesti oil fields?

PROFESSOR PETTEE:

Yes. I think there again it was somewhat less than the people in economic intelligence here thought, because the Germans were getting less oil from Romania than we thought. We thought they were getting almost all the oil that Romania produced and that by bombing Ploesti we would be denying them four million tons of oil. They were getting only two and a half million out of Romania, because Romania used the rest herself.

Otherwise I think it is clear that the oil target was the one first-class job of target selection that we had, that we can't say anything against. It was just as important as we thought it was. The individual details vary a great deal here and there. The selection wasn't as good as we thought it was, but a million tons of oil in the German war economy is tremendously important and two million is twice as important as that. Ploesti was within all reasonable accuracy what we thought it was, and we hit it.

GENERAL ARMSTRONG:

I want to ask you this question without any cynicism or disillusionment. In view of the iron censorship of Russia, what is your recipe for making an estimate of the situation about Russia's economic strength?

PROFESSOR PETTEE:

I would ask for a deadline date on that, and I would hope that the deadline was five years away. If you gave me a deadline within six months, I would try to round up the best brains I could trust to be

radical in the sense of a willingness to use unheard-of methods in order to work from a messy set of very incomplete and somewhat inaccurate data toward a guess which we might dare to bet on.

If you gave me a date five years away, I would adopt the method of the Army Industrial College and of the Intelligence College, which seems about to come into existence, and hope to train the brains that I want to use within a year or two; get a few men in the Moscow embassy and a few of them reading everything else available here in the Pentagon; and who can come up with a guess on the deadline date that I would be willing to back more heavily because the guess was good. I would work along some such lines.

The key factor would be to get brains free of false concepts and alert and enthusiastic about trying to solve a really tough problem, with a zest for trying to find an answer which would turn out in the light of hindsight to be the best answer that anybody could have got from the data available when it was made.

Is that a sufficient answer?

GENERAL ARMSTRONG:

You would have to depend on certain information that the Russians are willing to publish, wouldn't you?

PROFESSOR PETTEE:

Yes.

GENERAL ARMSTRONG:

From that you would assume that you could deduce an answer?

PROFESSOR PETTEE:

It would all be in a sense stuff they are willing to publish. Some of it would be what people saw who traveled through the country. That might be of inferior kinds. I don't know what your files look like now. I presume that Donald Nelson's observations and similar observations from other people are available. Then this man John Scott, who worked with Russian industry, has written a lot of stuff about it. Some of that may be obsolete, but there will be similar stuff in the future. There are other observations in Siberia. Anybody who gets there ought to put whatever he sees on the line.

Now, a well-trained brain with an efficient nose for significant details and so on can at least do a better job than a professor drafted suddenly and tackling a thing with no background for it, or with any of a variety of drawbacks for intelligence personnel during a war. There were all kinds of bad personnel work the way it had to be done.

The way to do good personnel work in that intelligence job in 1950 would be to have a group like those in this room now that you could take by the scruff of the neck and put with their nose to the grindstone making guesses at a risk on the evidence available, however imperfect it is, so that you would be able to use impromptu methods, even if you haven't got everything that the boys in the Department of Commerce would want in order to produce some statistics on the United States. You will have scraps and patches here and there. You must learn how to fit scraps and patches so you can do the job, not like the blind men and the elephant in Aesop's fables. When the elephant came to town, four wise men went in and gave him a feeling over. One said, "He is just like a rope." Another said, "You darn fool, he is just like a post." The third said, "You two fellows are crazy. He is just like a wall." Well, a fourth blind wise man could have read into that fable, "Yes. He is like all the things you say he is. He is a great, big animal with a tail like a rope, legs like posts, and a side like a wall," and so on.

Well, you can take scraps and patches and put them together. One curious thing about this war is the way our movies of Nazi intelligence have ascribed great cleverness and brilliance to the Nazis in putting scraps and pieces together. You may have seen some of the security movies that the British and the Canadians sent out, about how the Nazis pieced together scraps of information about a commando raid and the commando raid was not successful.

We ascribed much more intelligence to the Nazi intelligence service than we succeeded in implementing in our own intelligence in many respects. There were individual cases where we put the bits and pieces together and got a good answer; but those were not the big, important questions, like, was the German war production decreasing or increasing? Everybody in Washington and London said the German war production was in a decline, when there is evidence that that was very bad work, absolutely very bad work. But comparatively it was as good as was done. Nobody did any better.

A STUDENT:

I would like to ask if you would touch briefly on the point concerning the German economic capability and the estimates thereof. You mentioned German power and you say that we misjudged of its strategic importance. Will you elaborate a little bit on that theme?

PROFESSOR PETTEE:

I think it is simpler to refer you to the Strategic Bombing Survey study on the Effects of Strategic Bombing on the German War Economy. Everything I have to say would be quoting or paraphrasing from that. They said it all. It turns out by hindsight that German Electric power was a very tight factor throughout.

Now, the reason that we did not realize this was substantially that we imagined the peak of German war production to have been in 1941, with a decline thereafter. In that case they had power enough past the peak. They had more than enough for their present needs. There was a surplus of power in Germany. If we knocked out one power plant with a complete network system, we would have no effect on any. It was extremely difficult to get them all. That is the sort of reason why we did not do it.

Every agency that estimated the thing came up with the same judgment -- there was a general convention at least. I do not know of anybody who fought against it to any extent -- or claimed that there was only a narrow margin.

GENERAL ARMSTRONG:

We have a man who fought against it here with us.

MR. SWAREN:

We were told that the Germans had so many interconnections that it was impossible to affect the system by knocking out one or two power plants. But someone said those interconnections were at a lower level and simply would not carry the current. The bombing survey proved that Hermann Goering said he has a 300,000-kilowatt plant. He said it was about 75 kilometers away from the network. It was interconnected with the network.

The Goering munitions plant, if you recall, was destroyed. The power plant was not. It could not be used, simply because the wires to carry the power from the plant to the network were not there. You had the same situation in reverse at the Krupp works at Essen. The power plant was destroyed and the munitions plant was not. They could not get the power in.

Now, I must ask you a question which I hope is constructive.

In the next war unquestionably everybody will know that power is an important product. The American power industry is building a lot of new power plants. I am talking constantly with the engineers who are responsible for the design and construction. In view of your experience in the past war, can you make any suggestions that we can use in keeping intelligence relative to our new construction -- which, even as to that built within the last five years, will be in use thirty-five years from now -- is there any way you can keep that intelligence - I mean the details which would be valuable to the enemy - from getting into their hands?

PROFESSOR PETTEE:

Let me start off with a comment and then attack the question.

This is a perfect illustration of how complicated and how ill-organized the whole intelligence complex was. I knew of no critics of the judgment that power was a bad target. Intelligence must be much better organized than that, and our thinking on the whole war economy business must be better organized. The organization and the thinking reflect each other. If they are so bad that I can stand up here and say there were no critics, even with one sitting back in a far corner, it is the best illustration you can have of how fluid the thing was.

Now, as to trying to keep the secrets of our new power development from the enemy, I am not just sure what class of data on our power development you are talking about. I think there is no conceivable possibility that they will not know the location of every major power plant in this country. I do not imagine that can be prevented, unless possibly there is a fifty-thousand-kilowatt plant in Oak Ridge or something like that that they do not know about. I would assume that 99 per cent of the American power capacity will be known, by name, location, and capacity. All they have to do is to read the advertisements by TVA and look at pictures of the generators and so on.

If there is anything else about the electrical installations that would have military importance, I am an amateur on that. I do not know whether we could build them with bomb-proof ceilings and keep it secret that there is a bomb-proof ceiling. We might be able to do things like that. We might be able to arrange some kind of dispersal that would hide the thing to some extent and minimize the damage in case of attack and keep it secret that there was any such means of minimizing damage. Or we might design the plant and disperse it far apart, put the generators far enough apart so that not more than one could be hit at a time. There might be many other technical things about the vulnerability of our plants that it might be possible to cover and maintain a secret. But I wouldn't know what they are. So I would have to evade the last part of that question.

MR. SWAREN:

I am glad you answered it as you did, because you and I think the same. My feeling on it is that we must take risks, that there are certain risks that are necessary to run. There are little features here and there inside the plant that you can keep secret about the structure. But if the general location of the power plant is known, there is no way on God's earth by which you can keep that power plant from being bombed, that I have observed yet.

PROFESSOR PETTEE:

I would hesitate to try to convince anyone that there could be a 100,000-kilowatt plant in his home state that nobody knew about, that was a secret so that any thousands of people in the neighborhood did not know it was there. If thousands of people in the neighborhood know it is there, a potential enemy might know.

A STUDENT:

You have made several references to the conglomerate number of agencies that were involved in collecting and evaluating intelligence. I presume that you are familiar with the records set up by the National Intelligence Authority and the Central Intelligence Group.

PROFESSOR PETTEE:

I read the White House release on the National Intelligence Authority. Is that what you mean?

A STUDENT:

Yes.

PROFESSOR PETTEE:

I haven't read any of the directives of the Central Intelligence Group.

A STUDENT:

Anyway, the Central Intelligence Group, as we visualize it, will perform the functions of coordination. It also will perform the collecting of intelligence on the effect of the operating essentials in allocating, and such.

Now, in making up the personnel of that Central Intelligence Group, the directive says that they should be people now in the War Department, the State Department, and Air as the personnel for the operations of the Central Intelligence Group. Do you think the people should be all limited like that on their background? I have a feeling that that is a place where we need permanent experts in the economic or industrial field, but actually shifting and using these military people as a guide. Would you care to offer your advice on the types of individuals who should form this analysis section?

PROFESSOR PETTEE:

Now would be a good time to get together with some of these agencies of the Government. Immediately I would agree with you. I do not think you can have good strategic over-all intelligence as to the intentions of the enemy or how to make the Japanese government democratic within five years, or how to make India an independent nation by independent means, or how to handle Europe with some prospect of a democracy in Europe in one hundred years, or any such question, unless you have a group of people who have more or less of a lifetime interest to make an over-all calculus from economics, politics, military, and all other information.

Now, there are situations where somebody who understands the Catholic Church can give you a better judgment on what is likely to happen in Bolivian politics than a man who knows nothing about the Catholic Church. You may need a theologian in one spot or another. But you must have people with a sense of the over-all structure--that includes the political, economic, military, and all the technological considerations,--to do the quarterbacking of the job, and experts to know the details. In other words, you have to have a quarterback who understands the whole game and not just a gang of stars. If you are going to put in an all-star team, you first have to practice, before you decide on your key formation, whether this is going to be an line plunge or a forward pass.

You must have some people in long-term professions with good sense, sense that their lifetime job is to guess, with as good a batting average as possible on the over-all problems in politics, in economics, in technology--not only that, but some complex of all of those-who can understand or at least begin to imagine and evolve a system of calculus in among them.

We have a book on the shelves on the economic consequences of peace. Yet it is a staggering proposition to many intelligence agencies to suggest that the economy has political implications and consequences, that economic events have political implications, that political events have economic consequences and that social psychology is the general medium within which they operate on each other.

I would say that if you just draft people on temporary assignment to the central intelligence job, the central intelligence job will never be anything but a place where people might try to pin each other's ears back. You cannot in six months get political scientists and economists to sit down and evolve a system or reach a conclusion about political and economic problem; but if they work together for ten years, they will begin to get somewhere with the basic idea of solving their problem, whatever its plane of research is, without waiting to see whether it fits in with the old academic college departments or not.

The relation of present knowledge to the problem is, of course, the key thing. My feeling is that we must create what would be the doctrine for strategic over-all intelligence, because there is not anybody with it now. You cannot go to Harvard or Yale, Columbia, California, or Kalamazoo or anywhere and yank a man out who can tell you the political consequences of the economic situation and the economic consequences of the political situation and the military implications of both. They have been nine tenths wrong numerically on their guessing.

We must create the school and the atmosphere and the hot-house in which to grow the kind of brains that we need. We know how to produce airmen. We have done it in the last four years. There were none in 1904. We have some airmen now. We are going to need a class of crackerjack brains, or politics in the broadest sense, that I think does not exist today. We must figure out how to get such a thing when we have not got it now, how to get it in ten years. I do not think that you can do that

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by detailing so many people from the Army and so many from the Navy and so on. I am with you on that.

A STUDENT:

You said that the survey indicated that there had been an increase in the production of planes in Germany in spite of the bombing. Do you care to amplify that a little bit? My understanding was that they came up with very little air force toward the end.

PROFESSOR PETTEE:

Yes. Again I would say, if you want details, I think they are pretty thoroughly laid out in the Strategic Bombing Survey study on The Effects of Strategic Bombing on the German War Economy. If you take the over-all report with that report on the effects on the German war economy, take the two together, you get more, because the over-all report gives the weight of attack. The other one does not give the weight of attack.

The big attacks were in that single big week, in the last week of February, 1944. We hit every known German fighter assembly plant. The intelligence job on that was very familiar to me, because it was so controversial. We did a lot of arguing about it. My boys would come to me for support against the boys in the other agencies. Everything was thrashed out. The nearest guess was 50 per cent off the mark on what they actually produced thereafter.

They had had a great deal of surplus capacity. They had been working only one shift. They had started dispersal. A lot of our people thought dispersal lowered production, that a plant could not be dispersed and still produce effectively. My boys thought it could, because they knew of Grumman, as an American example, which was essentially 50 per cent dispersed through subcontracting. Immediately after the bombing, German single-engine fighter production went up.

Now, the question was, Why didn't the Luftwaffe make a better showing? The bombing survey showed that up to 90 per cent of the planes produced in one factory were destroyed on the plain outside the factory. In other cases they had tremendous losses in flying planes around for delivery, because they had ill-trained pilots. They had cut pilot training way down to save gasoline and so on. Therefore the plane losses were very high after those pilots got into combat. And in addition the losses on the ground were extremely high because we were strafing all their air fields from about May on. Our P51's could fly all over Germany and strafe everything they could hit.

Then finally I would say that one other answer that the bombing survey does not put its finger on is the scale of war. The Germans did almost as much flying in June, 1944, as in June, 1940. In June, 1940, their air effort looked like Gulliver to the Lilliputians. In 1944 it looked like

the Lilliputians from Gulliver's point of view. The decimal point had been shifted twice. It was incredible both times. The Luftwaffe was incredible to us in 1940, incredibly big; and the Luftwaffe, just as big as that, was incredibly small in 1944. I think that is a real part of the mystery. I do not know how much of a part. You can evaluate that yourselves.

A STUDENT:

What percentage of German industry would this bombed-out section have been if it had actually gone underground?

PROFESSOR PETTEE:

The survey gives over a million square meters of underground floor space finished. Nine million were planned and a million finished. A million square meters is ten or twelve million square feet. It is quite a lot of floor space. You can compare it better than I can with what figure you have in your mind as to the amount of floor space in our plants. I don't remember the floor space in Willow Run or anything like that, offhand.

COL. TAYLOR:

One of the student committees is examining the German industrial economy and their mobilization plans with the idea of extracting anything of use to our industrial mobilization. Do you have any recommendations to make to that committee as to what things are particularly interesting?

PROFESSOR PETTEE:

I would say the politics of the resistances to good war organization. One of the things I found most interesting was to go through the bombing survey study and pick out everything concerned with political resistances--local Gauleiters who wanted to preserve their civilian supply against war production because of pressure politics and so on. The people in the Wehrmacht and the War Production Ministry did not want to get a general index of munitions. I think you cannot tell what you are doing without a general index. I share anybody's skepticism on figures on gross national products, which may not turn out to be anything like the gross national products which the layman thinks the words mean, but you have to have a yardstick.

But you have resistances all along the line. I think they are very interesting to look at against the pattern of the morale in terms of the German morale improving with things like Stalingrad, improving from the war production point of view--their willingness to try hard and their willingness to take sacrifices. Things like Stalingrad and Normandy would be one thing.

Another thing that I suggested earlier is the point of the efficiency of labor. I think the strategic bombing study missed that, left it out. I think it is the most common big miss in the theory of war production, in what makes us go -- the story of the efficiency of labor, how we got the efficiency of the Kaiser shipyards as a final peak on record, and things like Boeing out at Wichita. That was where unskilled labor hit the high spots on its airplanes per man hour, and so on. That is the second biggest and most fascinating thing to study. That was outside the scope of what the Survey was trying to do.

Another point, if anything, would be the history of ideas on the subject. If you can follow me, by the "history of ideas" I mean ideas about war production as of given dates -- our own ideas about our own war production and our ideas about German war production and German ideas about German war production, as they developed in the course of the war. The evolution of ideas toward a more realistic sense of what an economy can do is a key towards any further evolution of ideas. We must grasp the fact that we can change our ideas and get better ones. In this intelligence picture I think you have to single out what you think is essential and can produce ideas. You have not got the ideas. You have got to produce them.

I think that in studying the German war picture the richest thing is the wealth of evidence on what people thought at the time and how long they thought it. That is clearer on Germany than it will ever be on Russia. You will never know what we thought about the Russian war production, because we did not think about it. There was never anything to think about except that we knew they were fighting quite a war. We were not wrong about Russian fighter production or ball bearings in the war economy or anything of that sort.

GENERAL ARMSTRONG:

Professor Pettee, we certainly hope the Industrial College can get you down again. I think in order to insure that you will accept the invitation, we had better have a little mercy on you. Thank you very much.

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