U. S. AIR FORCE PROCUREMENT

26 January 1955

1467

CONTENTS

Page

INTRODUCTION--Brigadier General Frederick E. Calhoun, USAF, Deputy Commandant, ICAF 1

SPEAKER--Major General David H. Baker, USAF, Director of Procurement and Production Engineering, Air Materiel Command 1

GENERAL DISCUSSION 18

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

Major General David H. Baker, USAF, Director of Procurement and Production Engineering, Air Materiel Command, was born in Paterson, New Jersey, 31 December 1907. He was graduated from the United States Military Academy in June 1930 and was immediately detailed to the Air Corps and assigned to the flying school. Upon graduation from the Air Corps primary and advanced flying schools, March 1932, he was rated an airplane pilot. His first assignment as a pilot was at Mitchell Field, New York. He advanced successfully through the various ranks to major general to which he was appointed 5 September 1952. In 1939 he entered the Harvard Graduate School of Business where he studied industrial management and was graduated with honors, 1941; chief of Plans Section, Eighth Air Force Service Command, 1942; deputy commander of the Ninth Air Force Service Command, 1943; and commander of the same organization, 1946; faculty member of National War College, 1946; senior Air Force member of the Joint Logistics Plans Group, 1948 to 1949; commander of the 5001st Composite Wing, Alaska, 1950 to 1951; director of Command Support 1951, Headquarters, AMC; appointed Comptroller, AMC, 1952. He became Director of Procurement and Production, Air Materiel Command, 1953. This is his first lecture at the Industrial College.

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GENERAL CALHOUN: Colonel Baird, fellow students: Unlike the Army and the Navy, procurement of material and services for the Department of the Air Force is vested in a single command. With the complexity of modern weapons, coupled with certain budgetary action of the past, it is not difficult to visualize the Air Materiel Command as big business indeed.

Our subject for discussion this morning is the procurement of complete weapons systems. Our speaker is General David H. Baker, Director of Procurement and Production of the Air Materiel Command. In that capacity I suppose General Baker directs the largest procurement activity in the world.

He is no stranger tc these halls, having graduated from the National War College and having been a faculty member there. It is a pleasure to welcome you, General Baker, to the Industrial College and to this platform.

GENERAL BAKER: Thank you, General Calhoun. It is a bit like home to be back with you today. I spent many hours in this building and many hours in this room, among which was taking a speaking course here. I am sure if I don't do very well, it is not because I am not familiar with this platform. I can recall standing here and having my instructor sit there and try to tell me what I was doing wrong. So in many respects it will be familiar for me to be back here with you. On the other hand it will not be quite so familiar as what I have been used to. As I look around the room I see friends, people I was used to shooting questions at and getting good answers. This morning they will shoot questions at me and expect good answers.

Your Commandant has asked me to talk to you about the weapons system concept. I am pleased to discuss this subject with you. It is very important to the defense of the country, not just to the military services. Its impact on industry has been very greatly misunderstood through the past several years and certainly through the past year. It has been misunderstood by industry; and it has been misunderstood by my own shop.

Part of this misunderstanding stems from the B-58 development which we have gone through in the Air Force during the past year. Part of it stems from our missiles programs. Those programs, the missiles program and the B-58 program, are exceptions to Air Force policy and will not be duplicated. I would like to make that clear. They are exceptions to current Air Force policy, and I do not feel they will be duplicated for a considerable length of time, if ever.

A good deal of the confusion about the weapons system concept also stems from the complexity of the problem and from the alternate solutions. Part of the confusion of this particular program that we have adopted comes from the fear of certain segments of the industry as to the serious effects which this particular type of concept may have upon them and upon their business. Because of this fear, they have, either intentionally, or, probably, unintentionally, misinterpreted the policy and its objectives.

In covering this subject this morning, I would first like to explain to you why I feel it is very important that I discuss this type of subject with you people who are about to enter or who are already in the logistics business.

Next I would like to discuss with you what it is I am talking about. That is not too simple. What is the weapons system concept? How does it fit into our program?

Then I would like to explain to you why the Air Force has been forced into this type of program--what has made it essential that we look at another means of doing our procuring and development business.

Next I will cover with you the impact that this has on the country and upon industry, which is very substantial.

I would also like to cover with you what we mean by the weapons system concept, and, in perhaps greater detail, what we might lose in the adoption of this kind of concept in the country as well as in the Air Force.

Then I will cover the course of action we have taken in the Air Force; and finally I would like to state what more I feel should be done with the concept as it exists today.

That is in general the approach I would like to make and the path I would like to take you down. I want to cover it briefly before I get started.

First, let us define the weapons system concept. A weapons system, by official definition, consists of the air vehicle, together with all airborne and ground-based equipment, plus the skills and supporting facilities required to make it a unit of striking power. That's the works. That's everything that has to do with this airborne equipment, that backs it up with people, facilities, and everything that makes it a complete weapons system. That is the official definition of a weapons system.

For the purposes of my talk this morning, I would like to exclude the skills of the people, since they are the public portion of the program, and to leave aside the material portion of the weapons system and talk about the weapons system concept.

Now, the timely development and procurement of complete weapons systems has always been an Air Force object; however, in the past, the Air Force itself has assumed the prime responsibility for the full integration of the materiel portion of the weapon. The Air Force has developed and procured the airframe, engine, instruments, fire control, automatic pilot, test equipment, ground handling equipment, and so on, from different manufacturers, and then had the airframe manufacturer put them together in one package.

Under the weapons system concept by a single prime contractor, the Air Force transfers the prime responsibility for the development and procurement of the materiel portion of a complete weapons system to a single contractor, normally the airframe contractor. This has become known as the weapons system concept.

I might say at this time that we have not adopted this concept. As I have said, we have modified it. I will discuss that a little later.

This is the essence of the weapons system concept. The responsibility which we in the Air Force have had for the complete integration, developmentwise and procurementwise, of complete aircraft, such as the F-102 or the B-47, in the weapons system concept is transferred to a single contractor. That is the essence of the weapons system concept.

What has happened in the Air Force to force us to move in this direction? First, and most important, our weapons have become more complex. In the 10 years since World War II, the performance of our weapons has increased much more substantially and greater than it did in the entire 25 years between World War I and World War II. That is a very important thing.

We are moving very fast at this time. Our capabilities are increasing very rapidly. Of course, viewing the papers any day is evidence of that fact. Our operational speeds have tripled, our altitudes have doubled, and our fire power has increased tenfold. However, we have had to pay for greatly increased performance in greatly increased complexity, much of which has resulted, as I have indicated, from the rapid advancements in the state of art. Much has resulted from the increased compactness of the air vehicle. The weight per square foot, or square inch, has increased drastically in the past 10 years. The aircraft is more compact. I don't think you need that explained. Any of you who has looked at a cross section of any airplane is amazed at the compact nature of it. A great deal of the increased complexity is due to the greatly increased use of electronics, which has been the most important single development to give this increased performance during the past 10 years.

All of you are familiar with the B-36 aircraft and with some of the problems we have gone through. Among the problems of advancing aircraft as we do, is the problem of integrating that aircraft into a complete weapons system. This aircraft was developed and produced under the concept of the Air Force retaining principal responsibility and working directly, developmentwise and procurementwise, with all the segments of the industry that were completing portions of the B-36, which were to be finally integrated into the complete weapon system by Convair at Fort Worth. The airframe contractor, again Convair, was expected to assemble this multitude of components into the airframe and to make the total system conform to all the applicable airframe and equipment specifications.

Despite great efforts at correlation, the complexity of an airplane such as this is so great that nearly every type of equipment, every component that was furnished for the B-36, had to undergo modification varying from minor adjustments to major design changes in order to perform the mission as required.

This particular experience has emphasized the need for more highly qualified engineers and procurement specialists to insure the full integration of the weapons system. Since these individuals could not be obtained by the Air Force because of manpower ceilings as well as salary limitations, particularly in the engineering area, action had to be taken to insure the full integration of the increasingly complex weapons system.

That is in general what happened specifically with the B-36. We had other problems in which we found ourselves getting into greater difficulty. When I took over the job two and one-half years ago, we had a problem with the F-89 out of Northrop. We couldn't get delivery. We couldn't get the fire system into the aircraft. It took many years to level the integration problem. Because of our experience with complexity and because of other problems affecting the weapons system, we were forced to adopt a new system.

I am sure that many of you wonder why such a simple step as merely transferring prime responsibility for weapons system development and procurement from the Air Force to a single contractor would have such an impact on the industry. Industry is in a great commotion over this problem. I spent last week with the electronics instrument industry in the New York area. There was not one out of the 12 contractors who did not raise the question of the weapons system concept and talk about it. Likewise, the problem is one of major interest to Congress. Right now we are preparing answers to Congress indicating why we have moved into this system, why we have had to adopt certain aspects of this system. There is very intensive interest in what we are doing from a political point of view. Of course the impact on the Air Force is great.

However, I would like to assure you at this time that this particular concept has a substantial effect on the aircraft industry, including both the airframe manufacturers and, more especially, the components and accessory contractors. I just mentioned to you the electronics instrument people. It has a very major effect on that very large group in our country known as small business.

This concept can have a definite bearing on our mobilization potential and the ability of our industry to recover after an atomic attack. It can have a very decided effect on our overall logistics system, including supply and maintenance, as well as transportation

requirements, and it can definitely affect, and has affected, the initial as well as the continuing costs of maintaining our Air Force year after year. I will cover each of these items in detail later on in my talk.

However, right now I would like to just give you a picture of the impact of this weapons system and let you know that it is a very important thing we are talking about. This very simple thing of transferring responsibility from us in the Air Force over to a prime contractor has grave implications.

Further, I think all of you here, in the Navy, as well as in the Army, should have become familiar with this system. I am sure the Navy will be confronted with this problem as its air weapons increase in complexity. It is my understanding that the Navy is considering this approach--if what I read in the papers is correct. The Army will be confronted with this problem if it goes into the development of the unmanned electronically controlled tanks which I read about recently in the press. This is something which I think is a coming thing. Where we go and what we do with it is of great importance to you in the logistics business as well as to the operational side of our Air Force, Army, and Navy.

Now, I have spent some time telling you why we went into the weapons system concept. What do we gain by the weapons system concept of development and procurement by the prime-contractor method, which is always inferred when I mention the weapons system concept?

First and foremost, we establish a single responsibility for a weapons system with one contractor who can eliminate much red tape, who can act decisively and quickly, and who can employ enough highly qualified people to do an effective job. This should result, and normally does result, in better performance of the weapon system by insuring that every item is tailored to meet a specific responsibility. It should also result in more timely availability of a complete system since a contractor can use shortcuts that may be permissible under Government procedures. It should result in a somewhat more modern weapon, since the contractor can place engineering changes earlier in his production line by eliminating a third party, the Air Force, from the act when a change is necessary in a component for the purpose of making the weapon much more modern.

This concept should also reduce the number of people needed to perform the development, procurement, and production function in the Air Force. This, of course, takes on increasing importance as our manpower ceilings tighten.

Much has been written about the advantages of the weapons system concept. I talked to some members of the faculty before the meeting this morning and they assured me that you do have people from the aircraft industry, such as Douglas, I believe, and Martin, who come down and talk to you. People in the airframe industry will be glad to talk to you. Mr. Esenwein of Convair will be glad to tell you about the advantages of this concept. I have gone through them rapidly.

I would like to spend a bit more time on the disadvantages, the problems introduced by the weapons system concept. In addition, I am sure that in your very fine and elaborate library you must have many articles on the advantages of the weapons system concept, many articles written by research and development people, by the military, and also by Mr. Esenwein of Convair. I believe that in the magazines there is a good deal written about the advantages and gains we have made from the weapons system concept.

I am going to spend a great deal longer talking about the implications of the system. I feel that you have ample opportunity to obtain information on the advantages as contrasted with the disadvantages of the weapons system concept from the visiting contractors when they talk to you, as well as from the magazine articles available to you here at the college.

Now, the advantages, as I said, are very substantial and very major. However, I would like to take a look at what we have to pay in order to achieve these advantages. First, obviously, the Air Force would lose considerable control over the major segments of the aircraft industry, since the prime contractor assumes responsibility for direct control over other contractors, subcontractors. What I mean by that is that there are many individual companies in the electronics instrument area and in other areas that deal directly with the big prime contractor. The Air Force, by doing this, automatically loses direct control over the segments over which it now has control in the aircraft industry. I think that is naturally going to happen, regardless of what we try to do. If we turn the responsibility over to another, we have to let the responsibility stay there. No matter how we look over his shoulder, we lose control.

This control has to be assumed by a dozen prime contractors, if we use only aircraft manufacturers and prime contractors through the country. We have perhaps a dozen. That is a very good round figure. Offhand this might not appear to be a bad solution. It might appear as a very good one to you. However, when this does happen, when the responsibility is turned over, our few prime contractors will tend to move the entire development and even the production processes into their own plants. This has already occurred in the missile programs. You don't need to do any more than pick up the paper in Washington any day and you will see advertisements for engineers--electronics engineers, instrument engineers, and so forth--from every major aircraft company. I have seen them for Convair, Douglas, Lockheed--any of them. The weapons system concept in which responsibility has been turned over to a single prime contractor has enabled the prime contractors to pull people into their own plants for their development and production processes.

I am sure all of you are familiar with the decrease in the Air Force program. We have been running on a 10 billion-dollar budget. We are dropping gradually to about 6.5 billion. There has been a gradual decline. With that decrease there is a tendency on the part of the aircraft manufacturers to maintain their own working forces as much as they can by pulling in the production that is being done by subcontractors and doing it themselves, rather than by leaving it with them and reducing the forces in their own plants.

If carried to the extreme, this will result in concentration of an entire weapons system in a few locations in the United States. This means that the largest single share (7 or 8 billion dollars per year) of the taxpayers' dollars will be concentrated in a very few large areas such as Los Angeles, Fort Worth, Seattle, and so on.

The adverse effects of such a move economically and strategically are most pronounced. Components and accessories manufacturers and small business located in other areas of the United States would be virtually eliminated from the aircraft program. Location of our entire aircraft potential in a comparatively few cities and plants would increase the vulnerability of these places to attack and certainly would make it a much simpler job for any opponent to hit us hard. Of course if our aircraft industry is located in a few places throughout the United States and those places were struck by atomic bombs, it would be much more difficult for us to rebuild the industry than if it were located at many different locations through the country.

Even assuming little bomb damage, our capacity to expand rapidly in a mobilization would be seriously curtailed if we were forced in mobilization to rapidly expand our components industry and small business when aircraft plants are fully occupied with meeting airframe requirements. We went through that experience at the beginning of Korea. The industry pulled in all the components and was doing the components work completely as well as the airframe production. When the whistle blew it was necessary to build up the components industry and the small business. The prime contractor had to use all his facilities and manpower to build up his airframe production and therefore it resulted in a bottleneck, not only in the production of airframes, but in components. No one else in the industry had experience in that requirement. In an emergency--building up facilities to meet requirements, the airframe people could do it easily. They had the equipment and the personnel. It was not possible for the components people to catch up with them. It did have a major effect.

Now, the basic problems in this area stem from the fact that the Air Force turns over to certain prime manufacturers the responsibility for working directly with major segments of the aircraft industry, and the Air Force itself would lose direct contact and considerable control over these major elements of the industry. Offhand this does not appear too bad, but let us examine some of the problems which develop when we take this course of action.

Up until this minute I have told you about the problems that we are going to run into, strategic problems, economic problems, and political problems, when the manufacturer pulls back into his own plant the processes of development and production of the entire weapon system. I am now going to discuss the problems we run into if the contractor has the prime responsibility but still lets development take place outside, or pulls development in alone and lets production take place outside. There is a bit of difference. I want to discuss some of the disadvantages that occur when a prime contractor lets development and production go out. Say our cameras go to Fairchild and our electronics stay with Sperry. These same problems are inherent when the prime contractor pulls in production as well as when he leaves production out and works as a prime contractor.

Under this our costs go up substantially. Vendors must now work with many different agencies. Prior to this they used to sell entirely to one agency, the Air Force. Now they must work with a dozen different prime contractors. It means that the sales organization has to

be built up. It also means they will be getting a great many short-run orders. When we in the Air Force order 10 aircraft, we order components for 10 aircraft, and we make sure that production is orderly, so that our components manufacturers can produce in an orderly manner. On the other hand when the components manufacturer is getting orders from 10 people, they wait before placing the order, which results in an up and down type of production in the component manufacturer's plant. That is another problem which comes up and which will cause some disruption in the industry and also have a very direct result on our cost. I might say at this time that this type of up-and-down production program in various segments of industry would be most disastrous in terms of cost. In our concern today with our own procurement and production, it is necessary that we keep a level program going on in the components program and level out the peaks and valleys of production.

Of course, if we hire a weapon system contractor to do our job, we will have to pay him for this service and in addition pay him a profit on all he buys for us. I have some actual examples of cost to the Government for contractor purchasing, which I have not spelled out. The fact is, I don't want to make this particular paper anything more than an unclassified paper so it can be used by you in a simpler way. I will give you, without naming the companies, the actual figures on particular items. The cost of an item by direct Government procurement was $40, the cost of the same item when bought from a contractor was $68; contractor procurement was $55, direct Government procurement $34; through a contractor was $72, direct, $43; $500 through a contractor, $435 direct. A good rule of thumb for cost increases through prime-contractor procurement is about 1 percent for engineering monitorship, 1 percent for administrative expense; and 7 or 8 percent profit, or an overall differential of about 10 percent.

A second major area that will definitely affect Air Force logistics is standardization. I am sure you have heard of the efforts of the Department of Defense to reduce the number of items in the inventories of the three services. I believe the objective is to reduce it by half. The weapons system concept will destroy standardization. It will result in not reducing by half but in tripling the number of items we have in the Air Force stocks.

Why will this standardization change occur? Our major objective is to use the same item for as many purposes as we can. The reasons

are obvious to you experts in logistics. When the Air Force maintains full responsibility for a weapons system, it can and does review all available items to determine their suitability for a new weapons system. That is natural when you are going to build a new weapons system with electronics. You look at the electronic gadgets to see that they meet the electronics requirement. You make your program for that particular weapon, knowing it will, with minor changes, perhaps, meet the requirement.

A contractor, on the other hand, is normally not familiar with all the items available for this purpose, even those under study by other prime contractors. Therefore, he will tend to go out for something new each time he has a new requirement. However, even if he knows of the existence of an item, he may well decide it is not suitable for his purpose because it does not precisely meet his requirement, and he is not in a position to weigh the logistic and cost implications of his decision with the possible limitations of performance of his weapon.

There is also the inevitable NIH factor, which all of us, as well as the contractors, are guilty of. NIH means "not invented here." There is no question that the engineer who decides what he wants and thinks it out in detail will almost automatically say that the gadget developed by or for the XYZ aircraft company isn't nearly as good as the one he has developed. Comments such as these are daily occurrences and in most cases are erroneous and unjustified.

I frequently talk to aircraft people about this and they deny it. I am sure there is evidence of it. I was at Bendix a while ago and it had three thrust meters which it was developing for three separate prime contractors when one thrust meter would have done the job without difficulty for all three aircrafts. Those are the types of things that cause problems.

There is considerable evidence to indicate that where the Air Force has in the past turned over control of instrument and accessory procurement to a contractor, standardization has suffered considerably. One striking example which has been researched very carefully shows that in the case of contractor procured pressure gage, various contractors had developed about 35 different types of pressure gages, each one of which had to be put in the inventory. Under the Air Force centralized type of procurement for this particular item, we were able to do the same job with two instruments with 5 separate faces.

That is an example of the way standardization would go. It is probably an extreme example. It was taken at random through research and shows it to be 35 versus 5, or 2, with five separate faces. Many other examples are available to indicate that while standardization should theoretically be available by many people developing the same item, it is seldom obtained.

What are some of the results of this trend away from standardization? First, it would have an impact on the costs of maintaining the Air Force year after year. Unnecessary duplication of items would require many more items in our logistics system to insure effective supply supportability of our combat aircraft. This is obvious when you realize that your overall requirement will be lower if you can meet it with one item rather than a dozen items.

For example, a week or so ago we were reviewing the consumption experience on SAC flyaway kits for C-97 aircraft and we found that only a very small percentage of the items we had in that SAC flyaway kit were used in the test period. When we inquired into it, we found that the reason was that the kits contained a tremendous number of items, only one each, "just in case." Think of the increased effectiveness that would result if some of those "one each" items could have served many purposes. Unnecessary duplication also results in higher warehouse and personnel requirements to take care of the added workloads resulting from higher inventories.

The impact is not as great in the maintenance area as in the supply area, but it is still substantial. More highly qualified personnel are required to maintain and overhaul the many different items. The production-line technique of overhaul and maintenance, which has proved so effective in reducing skill levels and training requirements, suffers with the increase in the numbers of different items in the logistics system. That is axiomatic to you.

Even supply and maintenance procedures and organization would be affected by a trend away from standardization. Our logistics system is now organized on the basis of common item control. In other words common items for all aircraft are located in one installation under one control. Definite trends away from standardization would require a change to end item control. There are some advantages to this change in organizational concept, but the new problems introduced are tremendous. I will not discuss them here, but I will be glad if anyone raises a question about that in the question period.

A direct effect on industry resulting from turning over development and procurement for complete systems to prime contractors, particularly when subcontractors are used, is the loss of control over maintaining a good industrial base. With so many prime contracts going to the aircraft industry, we might end up with only one or two sources for an item or we might end up with many sources. In the first instance our mobilization base would be in jeopardy; in the second our costs and standardization problems would multiply many fold. The problem of balance is a difficult one.

Also, in times of emergency it is very difficult to allocate items in short supply to many contractors if control over sources is removed entirely from the Air Force. I think in the last war Mr. Knudsen made a trip to one of the plants of a contractor furnishing the mobilization base--there were many contractors--and he found 20 different contractors' representatives in the plant trying to expedite the same item to fit all the different types of aircraft. It is a very different thing, where you have the contractor-furnished method, to what it is where the allocation can be done at a central point.

To summarize to this point, I have tried to show you the increased complexity of our rapidly improving Air Force has placed a terrific demand on our limited Air Force personnel, particularly in the engineering area, and to a lesser degree in the procurement and production area, to insure that our weapons systems are completely integrated in development and are concurrently delivered after procurement. A method to accomplish this is to turn responsibility for this task over to the contractor. However, this action will result in greatly increased initial costs for equipment, lack of standardization, with its resulting supply and maintenance problems, increased costs, and loss of control over a mobilization base. In addition to the degree that prime contractors pull some or all development and procurement into their own plants, the entire economic balance of the country is affected, our mobilization base is seriously weakened, and we are placed in a weak position strategically in the event of an atomic attack.

Very simply stated--and it is sometimes dangerous to state complex things in very simple terms, for fear of misunderstanding--the weapons system concept by a single prime contractor should, and undoubtedly will, give us better individual weapons systems under today's complex situations. However, it will have other definite detrimental effects on the Air Force, the aircraft industry as a whole, and on our national economy and mobilization potential.

As you can see, there are many problems inherent in the weapons system concept. Now, what can we do to resolve these problems? How can we take advantage of the good points of the weapons system concept and at the same time minimize the impact of the disadvantages which I have dwelled on at some length? In other words how can we have our cake and eat it too? How much authority and responsibility can we transfer to our prime contractors in industry and how much shall we retain directly in the Air Force?

One extreme is to contract with an Air Force manufacturer to fight a war or part of a war for us. In other words we make a contract with a prime contractor to build an airplane, train pilots, and then take it out and fight the war for us. That is one extreme. Another extreme talked about is to have the Air Force to design, build, and support its own aircraft. We have never intended to go, nor has anyone suggested that we go, to either extreme, but we have been confronted with the problem of how far to swing the pendulum from our present position.

In arriving at our solution, it was quite obvious that most of the advantages of the weapons system concept were gained during the development phase, and most, but not all, of the impact of this concept affected actions taken in the procurement and production phase. However, we can easily see that, unless we control the development phase vey closely and carefully, we will end up with many of the adverse effects, such as those resulting from lack of standardization which is established in the development phase, no matter how or what policy we adopt for the procurement and production phase.

Nevertheless, despite the pros and cons of this particular system, we did arrive at a decision. This is what the Air Force is doing today. I would like to go over it very slowly. This is where a great deal of confusion exists throughout the country. The decision was that development would be conducted under the weapons system concept by the single prime contractor method, and procurement and production would continue as in the past under the direct Air Force to contractor method. There are certain other provisions, such as the establishment of associate contractors, and so on, but I don't want to go into those. I am afraid it would confuse the basic point I have just made.

One important provision of the decision, which is included in our AF Regulation 70-9, always referred to in any discussion of the

weapons system concept, is that the Air Force would closely monitor and control the prime contractor during the weapons system development period.

Air Force monitorship and control of the development is the keystone to the effectiveness of this basic decision. Let us examine this very important element of this course of action that we have undertaken. It is very difficult to monitor and control the management of a weapons system development after a contractor has been given a contract to accomplish the development. It is difficult from a practical point of view under any circumstance, but particularly so in this situation, because the contractor can hire many highly qualified individuals, whereas the Air Force is somewhat handicapped in this regard. If the Air Force directs definite actions in too much detail and thereby infringes on the contractor's authority, the contractor can claim that he is not responsible. Then, some of the main advantages of the weapons system concept are lost. Also, from a very practical point of view, it is easy for Air Force personnel charged with monitorship to let the contractor run the show as he sees fit.

Further, we in the Air Force have never stationed engineer personnel in our plants as we do for contract administration and as the Navy does for engineering changes. Therefore, it is difficult for us to control from a central point, primarily at Wright Field, all the development and detail going on in any prime contractor's plant. So, from a practical point of view, it is not a simple matter for the Air Force to control and monitor the development of the weapons system.

On the other hand if the development is not closely monitored by the Air Force, and the contractor is given a free rein, he will tend to pull development into his own plant. This has been done in a number of major instances. Again I will refer to newspaper articles which are brought to my attention by components people, stating that big aircraft people are calling for thousands of electronics engineers and accessory engineers, for purposes of doing the development themselves.

Of course there is evidence of it, and it is true in the industry today, and it is a problem which we all may be confronted with, the shortage of electronics engineers as well as other types of engineers in the aircraft industry. It is being said that the aircraft industry has been paying engineers just out of college as much as they pay the president of the company. That's going a long way; I wouldn't say that is so.

If detailed development is picked up by the primes, and they can pick it up under the present concept, we are faced immediately with our standardization problem with its resultant logistic difficulties and increased Air Force maintenance costs. As each prime contractor develops and designs its own components and accessories, we lose all chance of standardization and we begin to take away from our accessory industry the ability to develop their own specialized product. There will be duplication of engineering between our prime contractors' plants, with a resultant overall shortage of engineers.

We do have at the present time considerable duplication going on between the primes working on the development of certain items, also among the accessory people, such as the electronics people, working on the development of the same item. That is quite evident today. I have many specific examples of that.

The next step that follows pulling in all development is late release by prime contractors of development plans to the accessory and components people. When release to the components people is too late, they don't have enough time to produce the item and get it into the aircraft in time to meet the current delivery schedule. Then the prime contractor will pick up the job himself and we are back into the difficulties we had under the situation about which I talked to you where the prime contractor pulled back into his plant the entire responsibility for production. In other words, we get into a position where we incur all the disadvantages we went through before.

Also, because of the complicated nature of much of our aircraft equipment, development and production preparation must proceed simultaneously. If the development is carried on by the prime without close cooperation with the accessory industry, the prime will end up as the only possible producer, because it will be difficult for the accessory manufacturer to take up engineering responsibility after the development plans are turned over to him. That is another aspect of the thing that is going on in the industry at this time.

What can we do to prevent the Air Force from gradually working into these very serious and far-reaching problems? We do have policy now and we are concerned about where it is leading us even at this time.

From this point on I am going to give you a few little thoughts on what we might do. They are under study in the Air Force at the

present time. I am throwing these out. Perhaps in the discussion period you might have suggestions as to what we might do. This is of great concern to us and to the country also.

One solution might be to force all development of other than airframes into the accessory and component industry. But in doing this we are inviting back our old problems of not obtaining a fully integrated weapons system for the Air Force. There's an out to that. I have talked to many manufacturers about this. We could turn over to, say, Fairchild, the responsibility for development of the complete photographic system for the B-99 or the B-110, whatever it might be, and charge them with the responsibility of having that completed when the manufacturer of the weapon system, Sperry, or some of those people, has fully developed the weapon system and all the equipment is ready to be fully integrated into the B-105, the B-110, or whatever it is.

We are examining very carefully that type of arrangement now. Some people think it is the answer. It assures you of a completely integrated weapon system when the airframe is finished.

We might require the prime to do only general development, that is, develop the outside box, where things fit together, and let the components fellows develop the inside, important part of the aircraft, and we might insist on a closer relationship between the primes and the accessory subcontractors in the development state. We should pass on all development plans of prime manufacturers and critically analyze those items which they intend to develop themselves. I mean, when a prime gets an order, he will come into the Air Force with those items which are components and accessories and state whether or not he will develop those himself or whether he is going to have the accessory industry develop them. He has to make a statement at that time as to what he intends to do, which will probably lead him in the direction in which the Air Force policy is so specific today; namely, that we must maintain the integrity of our accessory and component industry. In addition, where he does intend to develop or produce those items himself, they can be examined at that time by the Air Force to see if that is best for the interests of the Air Force.

These are but a few of the possible steps that might be taken to avoid many of the problems inherent in the application of the weapons system concept. We are presently studying other proposed actions that may eliminate these difficulties. We are endeavoring to retain

all the desirable features of the weapons system concept with a minimum of the far-reaching disadvantages. Only in this way can we be assured that our weapons systems are the best, the most modern, and the most effective. We must reach this objective without destroying our mobilization potential, without increasing our costs to the American taxpayer, and without building for ourselves very serious and insurmountable logistics problems.

Thank you.

COLONEL ROBBINS: Gentlemen, General Baker is ready for your questions.

QUESTION: General, I don't want to add to your worries. I know that in the past, where we have developed, let us say, a fire-control system, that fire-control system was usable in any number of fighters to which we might want to apply it. Now, as you mention, we and the Navy both often develop a series of fighters, and only one, say, of those fighters goes into production out of the three that we may have in the R&D stage. I want to point out that the weapons system concept, in addition to all the problems you have listed, can mean at the same time that we will have three, or two of the three, R&D fighters, because only one is suitable for production. Under that system you are about to throw out the complete component system, which, as you know, can cost as much as, or more than, the airframe itself; our costs can go to astronomical figures if we don't control that.

GENERAL BAKER: That is true. You mentioned fire control. I would like to make one point which I did not make in my talk, which has an impact on when we are going to get the complete weapon system. The lead time on the fire control today is greater than the lead time on the airframe. It means that, if you give the weapon system concept to Douglas to develop a complete aircraft, including the fire control, the fire control is going to be the limiting factor. We should have been a year or two before that developing fire control for X aircraft to be built by Douglas, Convair, or any other manufacturer. In other words if we are going to get timely delivery, in as short a time as possible, for the complete weapon system, the long-lead-time items, particularly the fire control, must be done before you go to the prime contractor to develop a particular airplane. We have that difficulty all the time when we go to the prime contractor and find that the lead time on the fire control is greater than the lead time on the airframe. There is a

possibility at this time that the fire control is so far behind that, as we get the completed aircraft, it will be out of date.

QUESTION: You have a more recent contract under Air Defense Engineering Services (ADES) designation, under which you have the privilege of refusal of any new component or change. Isn't that the answer to some of these problems of duplication you are talking about?

GENERAL BAKER: I think that is part of it. Are the people here familiar with ADES?

COLONEL BAIRD: No.

GENERAL BAKER: ADES is a very important project. I might take a minute to tell you about it. It is extremely important for the defense of our country. Under the contract we have let to Western Electric, they will have responsibility for the development, construction, and procurement of items for the complete weapons system defense in aircraft. What it involves is that we are installing in our ACW sites rapid computation devices. Information coming from the radar indicates that aircraft is approaching, and the electronic devices immediately tell the fighter where to go and lead him on to intercept the aircraft. It is done very rapidly. Somehow I am getting into difficult subjects today.

That's what ADES is. The point I want to make is that it is not aircraft. It has to do with a static type of system on the ground. We have turned over to the contractor the responsibility for developing that system for us. As the Colonel said, we have the power of veto on any item that is made by Western Electric.

I want to go through that again. If you recall, in my talk I said that type of control is very difficult. For example, the development of ADES is in New York. Western Electric, I suppose, has 200 or 300 people on the job managing the development of ADES. I have an office there which consists of around 15 or 20 people. How aggressively can they carry out their responsibility?

Secondly, we are able to physically locate this office in New York. I do not have an office of that type, with engineering type people, located at Convair, in Fort Worth.

There is some difference in the weapons we are talking about. There's a difference in the physical location of the office that is controlling the entire development. So I don't think that is entirely the answer. We are hoping for some good results with the Western Electric contract. It is a different condition than when I am talking about airplanes. It is not an airplane or a missile. It is a static system on the ground.

QUESTION: General, I didn't understand about the ups and downs of the subcontractor that you were talking about, in connection with this guaranteed wage business that is coming up. We had a seminar here the other day with a production manager of Ford, and he indicated that Ford's concept of a production line included all its subcontractors, so many thousands of them. He said that their production was integrated with the line, so that they have a steady production as long as Ford is producing. I don't see why that is not possible in the aircraft industry as well.

GENERAL BAKER: I suppose what you are saying is that they are subcontractors for Ford and that their work is for Ford alone, primarily.

STUDENT: That was not indicated.

GENERAL BAKER: When they do it for Ford alone, I can understand it. It is the same as doing it for the Air Force alone. To go back to explaining my point, it is, when you have 10 people who are prime contractors, all ordering different items from an outfit--let's call it Bendix in Detroit, or Thompson Products in Cleveland, or whatever it is--their orders will not be consistent enough to enable them to keep a steady production line, as would be the case if all the orders Bendix had were for one prime contractor. I think that would be obvious.

The bad thing, as I mentioned, is that the primes will tend to wait much longer than the Air Force will to put the order in, and they want it delivered much quicker--they want it today. Those are the things the accessory people complain about. The primes want the item today. They are not willing to wait. The production requirement, in terms of people and output, goes up tremendously. Then it slopes down again, and then Convair will come in, and then perhaps Douglas will come in. Then they may run into a situation where they have ups and downs.

We have contracts with equipment companies that have found these terrific ups and downs in production lines. That is tied in with the guaranteed wage condition. That is what Bendix is now concerned with. I don't know whether the guaranteed wage condition is tied in with the automotive industry, or whether they will be forced to adopt it. If they do, it will affect the cost of the products. As the annual wage moves up and down, it will definitely make problems for us. I think that is obvious.

I don't know whether I am answering your question. I don't know what Ford's situation is. If Ford is the only customer, if the subcontractor is making only Ford's products, I can understand it.

STUDENT: What Ford's representative actually said was that a big industry like Ford can figure lead times better than we can.

GENERAL BAKER: Better than the Air Force?

STUDENT: Yes, sir. He said the secondary contractors have a longer time to get the thing rolling into their line.

GENERAL BAKER: I think that is probably true with the automotive industry. The thing that is a great deal different in the automotive industry than in the aircraft industry goes back into things like electronics. We don't have an electronics item coming off the production line before we have something so much better that we are ready to stop production and get into the other item. That is not just electronics; it is across the board in the aircraft business. We are changing so rapidly, we can't catch up with ourselves. I don't know where we will be, at the rate we are changing at the present time. Electronics is a good example of a place where we are getting items pouring off the production line and where we are concerned with whether we should accept them or stop the order and get into something that is more effective. We might have a radio which gives us a range of 500 or 600 miles. If we get one which gives us 5,000 miles, should we wait or should we go ahead with that? I think it is a different situation in a rapidly changing industry from the situation in a stable industry like the automotive industry.

COLONEL ROBBINS: General Baker, on behalf of the Commandant, the students, and the faculty, I thank you for a very enlightening lecture and an interesting question period. Thank you very much.