SCIENTIFIC APPROACHES TO DECISION MAKING

Dr. Charles H. Kepner

NOTICE

This lecture has not been edited by the speaker. It has been reproduced directly from the reporter's notes for the students and faculty for reference and study purposes.

No direct quotations are to be made either in written reports or in oral presentations based on this unedited copy.

Reviewed by: Colonel Tom W. Sills, USA

Date: 21 October 1960

INDUSTRIAL COLLEGE OF THE ARMED FORCES

WASHINGTON, D. C.

1960-1961

SCIENTIFIC APPROACHES TO DECISION MAKING

28 September 1960

CONTENTS

Reporter: Grace R. O'Toole

Publication No. L61-36

INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington 25, D. C.

SCIENTIFIC APPROACHES TO DECISION MAKING

28 September 1960

COLONEL BURNSIDE: Gen eral Houseman, Gentlemen: The title of this lecture is Scientific Approaches to Decision Making. Our speaker is Dr. Charles H. Kepner, of Kepner, Tri[illegible], and Associates.

Normally, the further up the ladder we go the more reluctant and the less likely it is that we will expose our secret selves, our mental processes, to the scrutiny of ourselves or others. Yet, to improve our ability in decision-making, we must go through the process of dissecting and opening up this process of decision-making for observation and correction, either by ourselves--which is extremely difficult--or by others, so that we can compare our processes with some higher standard of performance.

Dr. Kepner is a decision-making surgeon who is paid by some of the leading decision-makers of the Nation's most competitive businesses who expose their decision-making processes to his critical view. Dr. Kepner's surgery is harmless but constructive. His patients usually consist of ten executives, composed of two teams, who sit for five days--each day for five days--or a week, playing the roles of production manager, distribution manager, and so forth.

Dr. Kepner listens in on the phone conversations and the conferences

that they have as these people, who are executives of a hypothetical company--The Apex Company--make the company's decisions and solve the company's problems. Then, as a critique, which is the high point in any training program, he asks some embarrassing questions: "Did you consider this, and did you consider that? What did you do? And what did you do?"

You can readily see that Dr. Kepner's patients not only expose to him the way they make decisions but, far more important, they get immediate personal feedback, which is a vital factor in the learning process. Each team can see what its members did as compared with the opposite numbers on the other team.

As a former Apex executive, my respect and my admiration for Dr. Kepner are of the highest order. I believe that he and his associates are performing a much-needed service to the Nation's top executives, some of whom are the generals of the cold war.

I am pleased to be able to present him to this audience composed of real-life executives for his first lecture at the Industrial College. Dr. Kepner.

DR. KEPNER: General Houseman, Gentlemen:

I want to thank Colonel Burnside for his very nice words here. If I am a surgeon, I am one who so far has not lost any patients. I think that I have given some of them a pretty rough time. Colonel Burnside,

while he was taking part in the program, I think, was having a rather interesting time of it. I think it might be interesting sometime to ask him what it looks like to really look at your own operation over your own shoulder where you are trying to solve problems in an organization under a lot of pressure.

The topic that I have today is Scientific Approaches to Decision Making. The description in the material which you have received I would like to quote:

"A survey of current theories and approaches in the scientific study of decision making, in particular the mathematical theory of gains, analysis of systems, processes of decision making in politics and international relations, theories of military decision making, and the study of political and economic choice; a brief consideration of the psychology of the act of decision making; and an analysis of the progress made in various fields in developing models and tools that will help executives and commanders in making rational choices among the alternative courses of action."

Well, I am going to take a pretty extreme position here. I think some people are going to disagree with it. I am going to take the position that the scientific approach to decision-making does not lie through models, gain thaories, systems analysis, and the like. I am going to contend that we have gotten so bound up in gimmicks, phraseology, gobbledy gook, if you wish, that we've got to the point where we can't

see the forest for all the trees. The trees are extremely fascinating ones. Mathematical models and formulae and studies of large-scale systems are extremely interesting. They are precise, they are neat, and they are clean. But I very firmly believe that this is not what we should be studying. I firmly believe that this is not where the important things are going to come, in terms of our knowledge in decision-making.

I think that we have to search for a break-through in decision-making. I think the break-through is going to come from other areas than from the area of development of sophisticated gain theories and so forth.

I think what we are trying to find is a big advance, not a one-inch advance.

What I am going to do is to present a couple cases here to try to illustrate my point. These are cases which I have documented very carefully, involved during the time the case actually developed, in two of the instances, and having access to just about all of the information involved in the third. These are a little bit hair-raising, a couple of them, but I think they illustrate a point as to where the important things about decision-making lie.

The first one has to do with a large airframe and electronics company on the West Coast. This is a company of roughly 40, 000 people. It's an outstanding company. It has a tremendous reputation and a well earned one. This company had grown very rapidly. The belief was that they needed

a new research center. They had been scattered in temporary buildings for a number of years. They wanted to pull themselves together in a single, good research center. This should be large enough to accommodate 1500 people and their staff people and their equipment.

The Vice President of Engineering, a brilliant man, a man who was largely responsible for the growth of this company, an extremely capable man, took the responsibility to look around the West Coast to see what he could find. After some time he found a plant that had been built by another firm. That firm's plans had changed and they had never moved into the plant. This was an organization with a very good operations research group, and they were able, though a number of different kinds of studies and analyses, to tie this plant up. This was a beautiful, modernistic plant, high on a hill, overlooking the ocean. It looked as though it ought to be a hotel.

They got it on a long-term-rate lease. The vice president reported back to his executive committee. These were his exact words: "I have pulled off a real coup here." They estimated at that time that the necessary modifications would cost about $500,000 and that they would be in it in three months. Actually they moved in a little bit more than one year later. The best estimate anyone could get as to the cost at the time of moving in was $5,500,000. This was somewhat overestimated.

They ran into a number of little things along the way that had not been taken into consideration in the basic decision. Here are some

items; One--this was out in the country, 15 to 20 miles. The sewage system was a septic tank, adequate for the people involved. They began to think, "We've got a research plant. This involves caustic waste. You can't put caustic waste in a septic tank." So they had to build a complete duplicate sewage system. Another item—they were going to have 1500 people out in the country. These people were going to commute by car 15 to 45 miles. There were no parking spaces. So they got bulldozers and they leveled off some hills and they built parking spaces. When they got through, the parking spaces were more expensive than the best car that could be placed in them.

They needed a source of pure water for laboratory purposes. So they built a one-million-gallon tank. Then they began to investigate and they found that the materials they had used in building the tank were contaminates themselves, and they had to rebuild it. They had to set in an elaborate water-purification system.

Their power lead-ins and supply were inadequate. They finally blew up a transformer substation, set fire to a hillside, burned a lot of personal property, and they are still working with a damage suit that came out of that.

The building has hundreds of huge panes of glass. It's about 90 percent glass. Here in a laboratory they have pressures, temperature changes, vibration, and one day they lost seven panes of glass. They came out like autumn leaves. So they had to go around and brace each window

separately, and they had to do this in such a way that it wouldn't interfere with the restrictions in the lease.

For almost a year, every day something or other like this came up. Well, in reconstructing, what happened? How did they ever get into such a decision? We can find that a great many of these things that later became problems for them came up for consideration. These were things that they talked about. But they never entered into the final decision. The final decision seemed to be based upon essentially four factors: How much did the lease call for in terms of cost? What would be the cost of moving in? The size of the plant facilities—it would handle 1500 people. Location and view--the esthetic side of it was pretty important. And the date of availability. A thousand other considerations had perhaps been talked about and had been worked over by competent people on the staff, but had not entered into the final decision.

You can point out some error here. In the first place, there was never a clear statement of what the purpose was, what they were trying to get done. No set of requirements was ever put up. These are the things we have to have in an adequate research plant and these are the things we would like to have--this was never stated. There was no systematic way of evaluating and weighing the data that were relevant to the decision that had to be made. There was no evidence of careful comparison between alternatives. The data were very incompletely used. And there was a disregard in particular for some of the consequences

of moving to this kind of a center located in this kind of a locale or setting.

This is one good example of poor decision-making, a very current one, taken from industry. I am going to come back to it in a minute.

Here's another case of decision-making that comes a little bit closer to home. This is an air defense command case . This was while I was with Rand doing research within ADC in a division which will be unidentified. We were using a simulated air picture. This is electronically projected into the radar equipment of a single station. We were observing and taking measurements, trying to find out what goes on within this particular kind of system. We were trying to determine what was the level of performance of people involved.

These were veteran crews. All the officers had had several years of experience in ADC. The officers involved were first lieutenants and captains. They were simulating the use of F-102's.

One of the simulated attack problems that we used had conditions of an alert being called, all civilian aircraft to land and the area to be cleared, an attack being imminent. In the electronic air picture against which they worked, here was one aircraft bouncing along at 7,000 feet, 150 knots, inland from the ocean, going up parallel to the coast. Obviously this was some civilian pilot who didn't get the word. He was near a critical area but not over it.

In every case in which we ran this problem three F-102's were

scrambled to intercept this private aircraft which was later identified as a Cesna. Within minutes after scrambling to go on out and look at this box kite floating along, other tracks would appear. These were high, around 40,000 feet, headed directly inland, unidentified, 550 knots. In all cases the intercept on the Cesna was never broken off. The high tracks were never scrambled on. Nobody ever went after them. They went straight on overhead, and in the simulated situation they went on to the target.

This drove people sort of mad, particularly those who were involved in the simulation. The people who took the position of pilot simulators, in other words, the men acting as pilots, the control officer could talk to. He became very frustrated, because he could see that this was not a very good decision for a control officer to make.

Finally this dialogue was recorded on one of the last runs, before we had to stop using this problem. The pilot reported: "I made visual identification--Cesna Angel 7, speed 150 knots." The control officer called back: "Does he look friendly?" The pilot said: "He doesn't look friendly to me." The control said: "What do you mean, he doesn't look friendly?" The pilot said, "He's a big, mean-looking Italian kind of guy." Control called back then, "How do you know he's an Italian kind of guy?" The pilot said: "He's been eating pizza pies and throwing the tin plates out of the cockpit window."

This is what frustration does to a guy who can see that this is not a

a very good decision that is being made, and yet he can't do anything about it. The point here is that all the time on the radar there were aircraft going high and fast and were obviously high priority. This was a very realistic situation. These men were working just as hard at it as they possibly could.

They had no conception of the total situation. They had no ability to analyze priorities and regulate their own action. Something moved--intercept it, regardless of what it is. They became too immersed in details to think, to really ask, "What am I supposed to be doing? How can I go about it fast? How can I use the resources available to me?"

In contrast I want to describe another case. This one is a little bit different, in that this, I think, is an outstanding example of decision-making. I think this holds a clue. This has to do with the Carnation Company, located in Los Angeles, a major supplier of dairy and food products. One of their products is bulk butter fat. The man involved here is a director of research, an extremely sharp individual. But in terms of what you might measure in intelligence and background training, he is no better qualified than some of the other people we have talked about here.

He got a telephone call from a customer just about two minutes after he got in his office one morning. I was in the building at the time it happened. I got in on the act to see what was going on within about 30 minutes. So I watched this all the way through. The customer was

a large user of their product. The customer was most unhappy. The bacteria count in butter fat that they had gotten recently had gone sky high, the flavor was off, and their product as a result was unsatisfactory. There was mention of such a thing as a suit for damages, the statement that they could get their butter fat somewhere else, and this was a really hot one, with very little to go on.

This gentleman assembled the facts as well as he could right on the spot in talking to the customer. He then called his supplier, the plant that they had which supplied this particular customer, and he got a meager amount of information. The plant that had supplied this particular customer was located in Ohio. The customer was about 75 miles away. They received butter fat in carload lots under refrigeration. These were shipped in 38-pound plastic bags. They were taken out of a separator according to standard operating procedure at between 75 and 85 degrees Fahrenheit. They were stacked on a pallet, quick frozen, and dropped to minus 20 degrees, and were held at this temperature, which was away below the level of bacteria multiplication, and were held at this temperature through the time they were shipped. During shipment the temperature might rise by 5 degrees.

So that what you've got here is a situation of material being taken, separated, bagged, stacked, frozen, and held at a very safe temperature during the time it was being handled.

This man didn't get shook. He sat and listed 60 questions. His

only tools were a quiet office, a pad of paper, and a pencil. These questions were of the what, where, and under-what-conditions variety--probing questions, to scare out information. They were to be asked of the customer and of his own plant, primarily about handling procedures, time, temperatures, and things like that. This took him about one hour and one-half. He spent a lot of time thinking during this time.

Then he got on the phone and spent one hour, almost exactly, on the phone. He talked to the customer and to his own plant. He obtained a body of information from which he selected what he said were critical items, items which he would refer to later--discrepancies, things which didn't fit.

He found that the package and shipping bacteria counts, the counts at the time of packaging and of shipping from his own plant, were almost identical. He said, "There is something wrong here. They are too close together." They were well, well within limits. He found that at that period of the year, because it was a rush period, they were taking butter fat out at between 95 and 105 degrees, instead of 75 to 85. He found that they were stacking these tightly on a pallet, 50 bags to a pallet. He found that there were no particular casings or strappings being placed over the pallet. He asked, Why? Didn't they jiggle when they were shipped? The answer was: No. When they put them in the cold room, as the temperature was dropped, moisture condensed on the outside of the bags

and they were welded all together into essentially one block of ice. He found that both plant samples were taken at the time of packaging, that one was counted immediately and the other one was held in the lab in a comparable refrigerator at the same temperature, and then was counted when the material was shipped. He asked them why they did this and they said it saved them from opening the bag twice.

So here was a control procedure that wasn't really what it seemed to be. He found that the customer thawed the material and used it at once, and the held material for sampling was in his lab for five hours at 95 degrees. Some samples were very bad and some were very good.

From this he specified the problem. He said: "For this customer, when butter fat is taken off at a high temperature, some bags test high and some test low in bacteria, making the flavor off in many cases, and our own quality-control bacteria count here is questionable."

From this he then generated four hypotheses as to what he thought the cause was. He said: "Plant test procedures are inadequate. This might be one cause of it." Then he had to ask: "If it's plant test procedures, why are some batches good and some batches not good?" He could shoot holes in this hypothesis. He then set up the hypothesis that the temperatures were too high at the take-off point. The bacteria count rises rapidly before it's cooled. If this was so, why was it that some batches were very good, again, and some very poor? Again he had to shoot holes in that hypothesis. He suggested that customer handling

procedures were not uniform. But he didn't have much information on this. All the information he had indicated that they were all right. He then came up with the hypothesis that the bags in the center of a tightly stacked pallet tended to cool more slowly and allowed bacteria to mount up before they reached the proper temperature. This checked out with every bit of information that he had.

He then set up some independent tests. He asked his people at the plant to tightly stack a pallet and take some readings on temperature and bacteria count as the thing cooled. He was able to verify this. The whole thing was wrapped up in about 36 hours. He spent about 5 hours of actual work in tracing this down. He took a course of action. Once he knew what the cause was, what his problem was, then he was able to state: "My purpose here in taking a course of action is to eliminate hot centers and to allow even, rapid cooling." His course of action then was very simple--pack the things so that there is a space between them, have fewer on the pallet, make some checks to see that this is adequate. It worked out that the cooling was very much more rapid. He was able to report to the customer what he had done and that this problem was under control. As I said, he did this within 36 hours. There was no further talk about damages or anything like that.

This I think is an outstandingly good case of decision-making. It took him about 5 hours.

Now, what did he do that the others did not do? I think this is a

critical question. First he took a systematic approach. He sat still for a little bit and he asked himself: "What have I got to do? How can I best go about it? What have I got to work with? What comes first?" Then he began a very disciplined and thoughtful use of the information, disciplined and systematic use. These are the key words, I believe. First he got the information out, and he found out what was going on. This didn't take him very long. Then he began to specify: "What do I expect to have happen here?" When he made this specification he was setting up some basis for comparison. (Goes to the blackboard.)

He first had to know what it was he expected. Then he could look at what it was he could actually see, what he observed. As long as things were actually occurring in line with what he expected, he didn't have any problem. The problem would occur when there was a difference between what he expected and what had actually happened. This difference is the key thing. He had to take, though, a very systematic approach and say, "What do I expect? Now what is happening? Now what is different?" These were the discrepancies that he picked up.

He worked over these. He went over the data until he knew what really were the differences, what were the indications that there was something going on. This was the information that he used to specify the problem.

The problem was not that the customer was unhappy. The problem was one that he could specify in terms of conditions of key things that

were different.about this situation, which may have had some relationship to the customer's being unhappy. Then he could back off and say that there was something which was causing one answer to be different from what he expected. That is what he had to find then. He had a firm picture of what the problem was and could go after what was causing it.

Once he had done that and had tested that out systematically against the data he had, then he could say, "All right. What am I trying to get done here?" He set up a purpose. This he had to state again systematically: "What am I trying to get done?" This would become his yardstick against which he would measure things that he might be able to do--alternative courses of action. Once he had set out what his alternative courses of action were he could then ask, after evaluating each: "All right. To what extent does this meet the purpose that I have set up? Does it achieve the purpose? Is it feasible? Does it carry with it consequences that are adverse?"

Once having had a standard here by which to compare a good statement of purpose, he could then select and say, "This one meets my purpose better than the other two." This was very simple and very straightforward. This is why it is important, because it is straightforward. He was taking a pretty systematic, rational approach to a problem that ordinarily doesn't get solved in that short a time.

The experience that we have had in working with hundreds of managers, in watching them solve problems, make decisions under highly controlled

conditions, and in documenting decisions made in industry, has led us to think that here is where decisions fall out:

1. From a lack of any systematic approach. The urge is: "Don't just stand there. Do something." So things are done in different directions.

2. From a lack of disciplined and thoughtful use of the information. It is used in a hit-or-miss fashion. There is an under-emphasis on preparation; there is an over-emphasis on implementation.

These are typical. You can document this over and over and over. They are unique as cases only in that somebody was around recording them. The people involved are bright, very capable, good managers. They are not knuckleheads by a long shot. The difficulty here is in a lack of thought and a systematic, rational approach to using the skills and intelligence with which the people are equipped. This is not something that happens to others. It happens all around us, as far as we can tell, in any kind of an operation.

Now, what is the answer? I don't think there is a complete answer, by a long shot, here. One thing I am sure of is that making decisions is a basic thing that a manager has to do. He has resources on one hand and he has things to do on the other hand. The decisions had better be good, because how he decides to use these resources is going to be the main determiner of how his operation comes out. There is a great deal of art in management in implementing decisions, but, if the basic

decision is a poor one, all the implementation in the world is not going to help it much. Things are going to get worse, in this respect, instead of better. Management decision-making is going to become much more complex. People are going to be under greater pressure and are going to have less time with closer margins, and the penalty for error is going to be greater.

There seems to be a glimmer of hope here. That is that some managers made a kind of break-through. (Going to the blackboard.) If you take a normal learning curve--in other words, any kind of skill that you can think of—and a person's performance tends to level off in time, this doesn't seem to be true about decision-making. Something else happens. In general some managers learn something and they go about like this: Managers with the same I.Q., the same background, and the same experience--somehow something happens--I think they make a kind of break-through. I think that the basic skill of decision-making, the way they learned it when they were kids, and brought it into industry, went something like this. They they learned another skill and another learning curve began.

Here is where the critical area in terms of improvement in decision-making really lies. What makes the difference? I don't know for sure what all goes into this. But I do know that, in going back and talking to managers who have made this kind of discovery, who have gotten a lot more out of themselves, over and over such things as a systematic,

rational approach came up, and such things as self-discipline. What they are really describing, I think, can best be gotten at here in terms of one man and his description of what he learned to do.

(Writing on blackboard.) He had been on this kind of plane for some time. Then, all of a sudden it seemed as though somebody had lit a fire under him. He is now one of your top technical people in the United States. I guess he is 39 or 40 years old. He discovered something. What he did was, he learned that he could spot problems better than anybody else in the organization. He was the director of a laboratory of about 2,000 people. He would have a matter brought in to him. He knew that tomorrow they would present him with a really hairy one. What he would do the night before, then, was to bone up, not on what they were doing but on what he should expect out of this situation. This would give him a basis from which to start, some standard of comparison. Then he would systematically, as they presented what they were doing, the observed portion of it, look for things that were different, look for discrepancies. In about ten minutes he could waive the briefing to a stop and ask a few probing questions. He had found something. He could turn over a couple of rocks and come up with problems, definitions of problems, that nobody else had been able to see.

His rise has been meteoric. He is a tremendously powerful man right now as the result of it. Look at people like Frank Pace. I think this man has the same sort of ability, a systematic way of approaching

a situation.

Now the conclusion here, I think, is, since some managers can do this, the important thing is to find out how you can teach other managers to do the same thing. It is my belief--and I have a very firm belief here--that the advances in decision-making skill are not going to come solely through a mechanization of decision, through routine machine formula and mathematical procedure. These are helpful tools. But the tools themselves very often are not very well used by line management, because line management has not found how to put these into effect, how they can really use them.

Very simply, I think they do not have a clear conception of a systematic way of approaching problems. I think this is what has to come first. I think that scientific decision-making is really a logical position which seeks to apply the careful approach of the scientist to the making of decisions. It assumes that there is a best decision possible for any given situation, with the information that is available, but that this can be gotten only if you have the best use of that information. It assumes that the best use of the information can be gotten only if a systematic, rational, thought-out approach is made to the use of the information, rather than a random, hit-or-miss approach. And it assumes that, knowing where you are going, what you are trying to get done, having made this planned and thought-out approach, then there is a basis for selecting and using the special techniques of data-handling and data

processing that are currently thought of when one talks about scientific decision-making.

I think that the scientific side of decision-making can be developed and will be exercised independently of the tools that are available--the mathematical model-building, and so forth. I am convinced that the systematic, careful use of information, really the scientific method applied to decision-making, can be taught and that this must be learned, that essentially, critical decisions are going to be made by men who have to sit with their conscience under a lot of pressure, without the benefit of special equipment and special procedures. The only thing that they will have to draw upon is the most efficient set of procedures they, themselves, carry within them for working with information.

From what we have seen we have the very firm belief that there is a heck of a long way further one can go in the matter of decision-making than we have seen to date, and that the important direction to be taken here is to consider the method, essentially the method of science, applied to a man's own way of using data, rather than trying to find a substitute in terms of a particular formula, a particular model, a particular theory, a mechanistic way of looking at the use of information.

Thank you.

COLONEL BURNSIDE: Dr. Kepner is ready for your questions, gentlemen.

QUESTION: Dr. Kepner, you discussed situations where you had fairly elastic matters of time and pretty good circumstances. Could you comment on a situation where you would find a tank commander or two commanders suddenly faced with a decision to either fire, turn, or make some decision very suddenly in a short period of time?

DR. KEPNER: I think that the people in the cases I have been talking about here are people who have not a great deal of time. In other words, there is a great deal of pressure, they've got to make a decision by four o'clock. This may sound a little bit off your question. I don't believe it is. I am not talking about the ideal situation where you can go and get a lot more information, and think of this overnight, and then make a very considered decision. I am talking about a situation where a man essentially lives in a box. He's got requirements and restrictions placed against him; and he's got time pressures. He has certain information available to him within that box. What he's got to do is to make sure that he uses the information as fully as he can.

I think the point is that if he moves efficiently, if he moves systematically through the information, it will take him less time than if he turns around in a number of directions.

The kind of decision that you are pointing to, where a man has to make a decision this way or that way within the next perhaps second or

minute, is one where the man, before he moves, has got to ask himself the same kind of questions, really: "What am I trying to get done? Do I have some standard by which I can make a comparison between alternatives and say which is the best?" He can't revert to a routine or a rigid way of dealing with information. He has got to assure himself, given this box and this information, that he has looked at everything and that is important/that he has to have in order to do this some kind of systematic way of approaching that box and that information, rather than just charging right straight ahead.

QUESTION: Dr. Kepner, to carry that discussion a little further, toward the end of your speech you inferred that we have to have the best decision possible in the time left. I have observed on my own part/and have heard from others that sometimes people in trying to reach the best decision pass the time of decision. I wonder if you could comment on that.

DR. KEPNER: I think I have to go back to this kind of thing--you have limitations. I think as a preparation for decision-making you've got to consider: What is the situation? What are the limits? What are the requirements? In other words, What is the room for action? Then: What are the resources available to me in the ways of information, people, facilities? What do I have to work with? And the third thing: What am I trying to get done?

I don't think that there is any magic way out. I think that decision-making is the most difficult thing a man has got to do, and it will always be the most difficult thing that he has to contend with. I think that what he has to do is to develop any kind of method here that will allow him to go through the information and make the decision with as little waste of time as possible, because most decisions are bound within a very sharply defined box here in terms of how much time and how much responsibility you have as things within which you have to operate.

QUESTION: Are you advocating a formalistic training in decision-making, or is this something that you see stemming from background training over a long period of time?

DR. KEPNER: I think it can be trained formally. One way by which it can be trained is to put a man in a situation where he has to make very difficult decisions and where he can get feed-back and find out how he went about it, and become somewhat appalled at how unsystematic his approach is. In this way he can learn a great deal about how he can be more efficient. I think this is certainly one approach to it.

QUESTION: Doctor, you gave us or at least I got the impression that you were speaking in fact about what is commonly known as the scientific method, although I don't know that you specifically labeled it as such. There has been a great deal written on that, and it has been pretty well articulated insofar as the major steps are concerned, so the process is relatively available to us if we want to use it. In recent years there

has been a great deal of emphasis on the technique that has been given the name of Operations Research, although it goes by various other names, such as Operations Analysis, Operations Evaluation, and so on. Would you make some comments with respect to the relative merits and possible application of the scientific method, as such, and the special application of it which is inherent in Operations Research and which utilizes the concept of an integrated team approach with various, somewhat heterogeneous, technical backgrounds and disciplines?

DR. KEPNER: On the first part, I certainly agree with you that what I am talking about is the application of scientific methods to decision-making, pure and simple. I don't think there is any other method for efficiently using information, or any method as efficient for using information.

In terms of Operations Research I think this is an application, as you say, of a scientific method, a formal way of manipulating information so that you can put together a great many factors and the efforts of a great many different sources.

All that I am saying is that this is a special application, and very often decisions, as I have pointed out, have to be made in short periods of time when one can't resort to a routine like that. I don't want to go on record as saying that things like model building and Operations Research, and linear programing, and so forth, are not good. Very

definitely not. But I think they do not hold the only answer. I think that there is another area, application of scientific method to decision-making, which is much more general and has much more application--and it has been largely neglected.

QUESTION: Dr. Kepner, in the services we have an analytical system for decision-making in all the staff studies. However, we find quite frequently that this becomes used as a tool to prove a preconceived point. If people have to be taught an analytical system of decision-making, it must not be very natural to them. In your experience with people who have had formal training in this, how many use the system only as a means to rationalize an intuitive decision, as opposed to those who really use it as a tool?

DR. KEPNER: I think that taking a rational system like this and applying it is hard work and calls for this matter of self-discipline for the people mentioned all the time when we talked to them. I think it is difficult. I think a lot of people would rather avoid it. But I think the men who have made this kind of transition--I am 100 percent convinced this is real--are people who have been "burned," if you will, enough times to realize that they have to do the uncomfortable thing; otherwise the penalty is going to be such that they don't want to live with it.

My impression is that people who are good decision-makers very consciously and very religiously apply this kind of method. It becomes second nature to them. I think it becomes easier as they go along, but

never as easy as sitting back and saying, "I was right before I really looked at the problem."

QUESTION: Doctor, your case in point, the ADC, I feel is not a proper decision-making situation, in that, as you stated, they were relatively young officers—lieutenants and captains, and a team composed of two sections. The boys on the scopes had been in school learning how to interpret a target, and they had weapons to intercept it. In the other part of the team the pilots in the cockpits were taught that they must follow the instructions of the air controller. Now, if you brought an evaluator into the picture to help to make the decision to drop that low bogey and get that high flyer it would be the answer. But these boys are in that little box, in my mind, trying to be systematic in the use of tactics. I feel that maybe some managerial claim or a change in doctrine might be brought into the problem.

DR. KEPNER? I think this is true. I think that these men, as you say, were in the box under a great deal of pressure. But there was one man there, as control officer, who had to make a decision: "What is the threat? What resources do I have?" The whole thing hinged on how he used the information and what he did with it. What happened was that he just went after the first spot that appeared and disregarded the other information.

I agree that an evaluator, a person who acted as a manager, who worked with the whole organization there, would have helped. But I

think that the man who has to make the decision also ought to become that manager. He could do a much better job than he did. I think that this is something he could learn. I think that in the course of the research we pushed pretty heavily here on what was happening, and very substantial learning did take place.

QUESTION: The discussion here has been on individual cases. Could you give us your estimate of how much on a back audit of decisions those decisions proved over chance, over a 50-50 break--this is now for some of the organizations--and what we could hope for in the way of improvement over this percentage?

DR. KEPNER: I think I'll have to answer it in a little bit different way. I think that the assumption of the man in the box with the information that is in the box available to him there is the best decision that can be made. You can call this a 100-percent decision if you wish. This may be only one fraction of the information he would like to have but this is what he's got to work with. This goes clear on down to just a no-good decision. Now, as he uses less of the information that is available, or as he puts in assumptions, as the information is dropped or not recognized, the possible decision degrades.

My bet is to see the decision made in a highly controlled situation and, in documenting real decisions, on the average about one-third of the information that might enter into a decision and would be critical to the best decision actually is considered.

In the case of the research plant, I think that one is down right about there (indicating). I think there is a great deal of information that should have entered into that decision that got dropped down through the slots. Now, where could you go from this? I think the illustration of the man at Carnation is one of very rapid decision-making and problem solving. He did this in a very short time. This is an industry where the trouble was in Ohio and the only contact he had was over the telephone. I think that he was batting right up in here (indicating 100).

I think a lot more information can be used than is being used, given some approach to getting at it and working with it.

I don't know whether this really answers the question you asked. This is as close as I could come to it.

COLONEL BURNSIDE: Gentlemen, our time has run out. Dr. Kepner, you have given some of us an insight on what we've got to do to make good decisions. On behalf of the faculty and the students, thank you very much.