RESEARCH AND DEVELOPMENT IN UNIVERSITIES

24 September 1951

CONTENTS

Page

INTRODUCTION—Mr. J. W. Swaren, Member of Faculty, ICAF 1

SPEAKER--Dr. B. R. Van Leer, President of Georgia Institute of Technology 1

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INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

Dr. Blake R. Van Leer, President, Georgia Institute of Technology, was born in Mangum, Texas (now Oklahoma), 16 August 1893. He received his B.S. degree in 1915, M.E. degree in 1922 from Purdue University, and M.S. degree from the University of California in 1920. He studied at the University of Caen, France, in 1919 and at the University of Munich, Germany, in 1927-1928. He received his Sc.D. degree from Washington and Jefferson College in 1943 and his D.Eng. from Purdue University in 1944. He has held the following positions since 1915: instructor and assistant professor of hydraulics at the University of California, 1915-1928; engineer with Southern Pacific Railroad, Byron-Jackson Pump Company, 1928-1931; assistant secretary, American Engineering Council, 1928-1932; dean of engineering, University of Florida, 1932-1937; he consolidated colleges of engineering of University of North Carolina and North Carolina State College, 1937-1944; Florida representative of U. S. Coast and Geodetic Survey, 1933-1935; technical adviser, Florida Emergency Relief Administration, 1934-1935 and Florida State Planning Board, 1934-1937; water consultant, National Resources Commission, 1936; vice president, Florida State Board of Engineering Examiners, 1937; chairman, Georgia Ports Authority, 1945-1949; member, U. S. National Commission for UNESCO, 1946-1949. During World War I he served in the AEF as a first lieutenant in the 316th Engineer Corps, and during World War II he served in various staff assignments and rose to the rank of colonel. Dr. Van Leer has been President of Georgia Institute of Technology since 1 July 1944.

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MR. SWAREN: Gentlemen, I have today not only a pleasure but an honor in introducing our speaker. You have read his biography and no doubt have formed an opinion that he is just another college professor, just another college president. I assure you that you are wrong.

Dr. Van Leer knows what a field soldier is like. He has plenty of decorations for the things that field soldiers do. I think this is the best example that I can use to point out the sort of chap he is--one day we were discussing the Meuse-Argonne offensive and I mentioned how we would fight all day and at night sleep under a haystack. He said he had come to the conclusion that World War I was just about as comfortable as you could expect a war to be.

I have known Van Leer for 40 or 45 years now and I want to tell you he is a real fellow. With that I am going to turn the platform over to him. I hope you will do a good job of shooting during the question period. I don't know whether to call him Dr. Van Leer, Colonel Van Leer, or just plain Van, but anyway here he is.

DR. VAN LEER: General Holman, friend Swaren, gentlemen: It is a distinct pleasure for me to be with you here today. In responding to Major Swaren--I can't help calling him Major because that is what he was when I was a second lieutenant, so I always looked up to him with a good deal of respect as I do today--but having slept together in a pup tent, there was an equality there, and therefore what he says must be taken with a grain of salt.

It is not often that a university president can corner a high-ranking audience like this just to hear him talk. But from what I am told of your studies here, I gather that you are as vitally interested in the problems of research and research manpower as we are at Georgia Tech. I would like to tell you something about these problems, as we in the universities see them, and attempt to outline the university's position in the changing pattern of research and development.

Change is about the only certain thing in this dynamic world of ours--tomorrow is always different from today. Today's problems have to be solved from the knowledge and experience

accumulated during many yesterdays. So that we will be prepared to deal with tomorrow's problems, it behooves us to look forward today. This function of preparing for tomorrow through study of the past, creative thought in the present, and guided prediction of the future is, by and large, the province of the educational institutions.

How do we prepare men to be creative thinkers and planners? To answer this question, let us take a brief look at our educational system.

First, we have the grade schools. Here, from kindergarten through the eighth grade, a child is supposed to learn to read, to count, and to write. In other words he acquires just about the minimum amount of knowledge for existence in the world today.

Second, there is the high school, where again a child is taught only what are supposed to be well-known and established facts. There are few controversial or speculative things introduced here. A child should learn to read rapidly and comprehensively, to express himself in writing with considerable facility, to solve mathematical problems by the use of higher arithmetic, algebra, and geometry, to learn the basic facts of history and the fundamental political institutions of his country, to learn something of the geography and governments of the world, and to lay the groundwork for a vocation. Upon graduation, the boy should have the minimum education for earning a living and fulfilling the duties of citizenship.

Third, we have the liberal arts college. Here the youth is expected to acquire a more mature and masterful comprehension of all he has previously learned, to develop the ability to study and discuss intelligently various controversial theories and hypotheses, and to secure either a broad general education or a specific foundation for subsequent graduate and professional studies.

Finally, there are the universities and the professional schools. Here the student's education is broadened or changed substantially and numerous routes are open to him. It is not necessary to enumerate the many subjects he may choose, the career he may decide to follow, or the degrees he may attain. But if he plans to become a research scientist, he may start from almost any bachelor specialization, following it with some specialization toward a master's degree, and working toward the ultimate goal of a doctorate. The specializations for a Ph.D. are varied, of course, depending on the field of specialization. But one prerequisite is recognized as standard—the ability to plan and execute independent research.

We see, then, that in the universities and professional schools, the research scientist is incubated, cultured, and trained for his future work. Research is the thing that sets these institutions apart from the grade schools, the high schools, and the liberal arts colleges. The latter deal almost exclusively with known or accepted knowledge, while the universities push on into the realm of the speculative and the unknown, seeking to acquire new knowledge for application to tomorrow's problems. This is the atmosphere that breeds researchers.

I need not expound the importance of research to technological progress, since we are all agreed on that score or we would not be together here today. However, I would like to point out that graduate-level education is as essential to research as research is to progress. Graduate programs provide both the raw material and the manpower for the prosecution of research. By "raw material" I mean the new concepts and basic data emanating from pure research conducted by candidates for advanced degrees and by the high-grade faculty members engaged in graduate education. These concepts and data serve as grist for the mills of the applied researchers. Thus, the graduate programs of our universities are the breeding ground of the research scientist and engineer. It is here that young men learn the methods of research--those techniques which they will employ in later years to advance the frontier of scientific knowledge.

Before discussing the university's position and problems in the changing pattern of research and development, we might review briefly how that pattern has changed. I believe some of these data have been previously presented to you in other discussions, but it will do no harm perhaps to review it to be sure we are on common ground.

Immediately prior to World War II, there were about 45,000 persons engaged in all types of research in the United States. The total national expenditure for research was about 350 million dollars, much of it spent by a relatively few forward-looking industries, such as the petroleum industry and the chemical industry. University research, though limited rather severely by lack of funds, was then, as now, the primary source of basic research. There was also a growing appreciation of the value of nonprofit research institutions, largely as the result of the demonstrated success of the Mellon Institute, founded in 1911; Battelle Memorial Institute, established in 1929; and Armour Research Foundation, a newcomer in 1936 but already making itself heard. Armed forces expenditures for research

and development in 1940 amounted to about 22 million dollars, approximately one-fifteenth of the national total.

Then came World War II and an unprecedented growth in our research effort. As of 1945, the military research expenditure had increased to 600 million dollars and the national total to 1.1 billion dollars.

In the five peacetime years prior to the Korean incident, the military research and development budget, exclusive of atomic energy, averaged about 500 million dollars per year and industrial research about 800 million dollars.

The pattern changed again following the outbreak of hostilities in June 1950. At present the military research and development program is running about 1.1 billion dollars annually, with a further increase of about 200 million dollars expected in 1952. Our total national research effort is variously estimated at 1.75 to 2.3 billion dollars, so we can see that military research now constitutes somewhere between 48 and 63 percent of the total research expenditure, as compared with slightly over 6 percent in 1940. The total national expenditure for research is now from five to six and one-half times as great as it was just before World War II. The military expenditure has increased fiftyfold. I believe you will agree that we are safe in speaking of the "changing" pattern of research and development.

What has been the impact of this change on the Nation as a whole and the universities in particular? First of all, as might be expected, it has created a drastic shortage of research manpower. We have already seen that there were some 45,000 persons engaged in research in 1940. Today, there are roughly 130,000, or about three times as many as in 1940. However, the research load, on an expenditure basis, is around six times that in 1940. If we assume that inflation has cut the value of the research dollar in half, we find that the research load, on a man-hour basis, and the number of men employed in research have both increased threefold. There are strong indications that this is our current, manpower-limited capacity to prosecute research.

How bad is the research manpower shortage and what are the prospects of relieving it? Much study has been devoted to these two questions. A June 1951 survey of the needs of 378 companies and government agencies indicates that about 80,000 engineers are needed now, exclusive of the needs of the military. The report went on to state, and I quote:

> "When the current graduating class of 38,000 is absorbed, there is still an unfilled demand for 42,000 engineering

graduates. However, a recent survey of the 1951 class of engineering graduates showed that the military, through ROTC and reserve programs and through the Selective Service System, will siphon off about 19,000 engineering graduates. The actual unfilled demand will then be far more than 60,000 engineers."

I believe you can see from this quotation that the defense industries face a tremendous problem. Half of the engineering school graduates are being taken into the services, one way or another. This means that so far as filling the demand for engineers goes, we are taking two steps forward and one backward. On the one hand, our Government deplores the shortage of engineers while, on the other hand, it makes it impossible for the colleges to produce a full crop. Sometimes I wonder if we aren't with Alice beyond the Looking Glass where we must "run awfully fast to stay in the same place."

Commenting on the survey I mentioned a moment ago, President Killian of M.I.T. recently had this to say:

"Based upon present enrollments, estimates have been made which indicate that in 1954 we will turn out of our engineering schools from 12,000 to 16,000 students. This compares to an output just before World War II of some 20,000 engineers a year. The country's demand for engineers is greatly in excess of what it was before the war. Estimates now place the annual demand around 30,000."

The foregoing indicates the shortage of technically trained manpower, but I would like to emphasize that these figures, pitifully small as they are, are not truly representative of the research manpower shortage. The figures I have quoted also include the "garden variety" of engineer; that is, the bachelor or master without the specialized education, temperament, and initiative required in effective researchers. About all any of us can say about the research manpower situation is that it is bad and due to get worse unless the Nation as a whole, and the Government in particular, back up our universities by recognizing the necessity for expanded enrollments and uninterrupted student attendance in programs extending to the highest levels of graduate work.

I am often asked whether I think universities should engage in research for the armed forces. To my mind that is a pointless question at this time. Necessity dictates that they must. The magnitude of our Nation's defense research program requires maximum use of the fine minds available in the universities. We already have seen that the country's research capacity is limited by manpower, not dollars.

334

Dr. Eric Walker, Executive Secretary of the Research and Development Board, recently estimated that 35,000 of the 130,000 persons in the country capable of performing research are employed by our colleges and universities. To complete the breakdown, 70,000 are employed by industry and 25,000 by the Government. As a nation confronted with the prosecution of a gigantic military research program, we simply cannot afford not to make optimum use of these 35,000 potential researchers in our institutions of higher learning. Yet these men, distinguished by their ability to teach as well as to perform research, must not be taken away from the supremely important, longer-range function of educating the researchers of the future, which seems to me to prove conclusively that there is only one solution permitting the optimum use of both their teaching and research talents--that is, to bring defense research onto the university campus.

Please understand, I do not advocate saddling the universities with "hardware" developments or testing programs, and I do not believe any educators advocate this. But there are a number of vital defense problems which require the cooperative efforts of researchers from several branches of science for their complete solution. The engineering research stations and research institutes maintained by universities have, in general, just the sort of diversified staffs and versatile laboratory facilities to tackle problems of such nature. Using popular terminology, it is a little hard to define just the type of problem I mean--perhaps "basic applied research" hits close to it. Where projects are even more basic, with candidates for advanced degrees as the investigators and faculty members in the fields of specialization as the research directors.

As I see it, the universities can handle problems of these two types, basic applied and basic, as well or better than any other agency whether in government or industry. I would say better since the profit motive does not exist and, consequently, pressure is not brought to bear to produce preconceived results in an area where such are not possible. The university researcher's own background and that of his colleagues is broad enough that together they can often see practical applications of research results that likely would not be apparent to the industrial researcher working toward a specified goal.

A couple of minutes ago I said that I considered it pointless to ask whether universities should engage in military research, since the pressure of the times makes it necessary that they do. I did not mean to evade the question, and I would now like to point out some of the more often cited pros and cons on the subject. My comments will apply, in most cases, equally well to military research or industrial research, since both are sponsored and both tend toward the practical as contrasted with lily-pure science.

I will start with the "pros," because frankly I am a pro-sponsored-research man and I think I can make a better case for the advantages than for the disadvantages. Briefly, I am for sponsored research because it helps the universities to get and hold top-flight men and it prevents withdrawal of teachers and students into completely abstract theory. The opportunity to perform research with some promise of eventual application holds many excellent men whose deep interest in the problems of industry might lead them to give up teaching if they were forced to choose between one or the other. Similarly, the opportunity to teach without abandoning research attracts to universities men who would not be willing to sacrifice the stimulus of research for straight teaching. Since university teachers like to have their families eat as well as anyone else, the fact that research contracts permit better salaries is another important advantage in building a strong faculty. This is very significant today when the shortage of competent men prompts industry and government to raid the universities for personnel. Research projects are also an effective preventive of "ivory towerism." They keep the thesis research work of the graduate programs from becoming sterile and purely academic. There is no doubt that the teacher who engages in research has to keep abreast of his field--right up in the front lines. This intellectual stimulus is passed on to his students who benefit accordingly.

To me, the disadvantages of sponsored research are more illusory than real, except that any good activity carried to the extreme tends to become a vice. Admittedly, it is possible for a faculty member to become so engrossed in research that he will neglect his teaching. The answer to this is simply--use him full time on research and find another teacher. We get around this situation quite well, I think, at Georgia Tech. by permitting the Engineering Experiment Station to hire faculty members part time as consultants or project directors in their field of specialty. These men are primarily teachers, but also researchers. The Station reciprocates by lending selected research personnel to the academic schools for advanced teaching in their specialties. They are primarily researchers, but also teachers. Naturally, the bulk of the Station's work is carried out by full-time researchers, but this interchange seems to act as a catalyst for both the educational program and the Station research program.

There is also the danger that applied research will become the tail that wags the dog so far as fundamental research goes. If I really believed this likely, I would change my attitude toward sponsored research in universities. However, I believe that it works the other way; namely, wherever considerable applied research is carried out, developments off the beaten path of the

investigation in hand suggest promising avenues for basic research. In a university these can be pursued by the same research team or others, the result being more basic research rather than less. Also, basic concepts and new data coming from fundamental research on the campus can immediately be incorporated into applied research going on there. This eliminates the very considerable time lag in dissemination of basic research results through publications in the academic or technical journals. And, as you know, some theses lie embalmed, to all intents and purposes, in university libraries all over the world. In 1908 Paul Gelmo submitted a doctoral dissertation on the synthetis of para-amino-benzene-sulfonamide from coal tar. It wasn't until 1935 that his work was unearthed and given to the world as sulfanilamide. Correlation of research results and coordination of research effort is best attained where fundamental and applied research exist side by side. I believe we should have both in our universities.

I also believe, however, that there are some things that universities must guard against in taking on sponsored research. First and foremost is the potential loss of academic freedom when one accepts money to perform research. There has not been any pronounced tendency of the Government or of industry to dictate university policy, so far as I can say from our experiences at Georgia Tech. However, both the Government and industry are prone to expect the attainment of a specified goal at a specified time. To point out the fallacy in this approach, I would like to quote from Armour Research Foundation's pamphlet entitled, "To Our Sponsors."

> "To begin with, research takes time for fruition--lots of it, as a rule. Things have to be done in logical sequence, and frequently the second step is not apparent until the results of the first are in. It's not a simple question of man-hours. Up to a certain point the job can be speeded up by increasing manpower; but beyond that point, if you expect to complete a research project by doubling the staff, then you might just as well try to cook a 3-minute egg in 1½ minutes by using two cooks. Furthermore, the total elapsed time for solving a problem depends upon the problem and bears absolutely no relationship to the personal wishes of the business man, his board of directors, or his sales and advertising departments."

Another disadvantage of undertaking sponsored research for the Government is the fiscal procedure that must be followed. "Quadruplicate this" and "dozen copy that" run into a lot of red tape that cuts deeply into technical time that could be more usefully employed. This probably results from an attempt to make the sponsorship of research fit into a standardized legal governmental pattern developed for the procurement of material things.

A very real danger in sponsored research for the Government is posed by the efforts of some agencies to beat down the university's overhead to a point where it cannot cover the cost of carrying out the contract and, in effect, the university finds itself subsidizing the project. As you all know, university finances are on thin ice these days, and only the most highly endowed can afford to take on projects that threaten to be a liability rather than an asset. Most universities are deficit-operated any way, and an increase in their scale of operations tends to increase the deficit.

I might also mention that since we took on a heavy program of sponsored research at Georgia Tech we have experienced a sharp dropping off in the number of publications per unit dollar volume of research conducted. This is partly explained by the security restrictions necessary in government projects and the confidence in which work is often done for industrial sponsors. Nonetheless, it is a sacrifice for the individual researcher when he cannot publish his results, because his professional reputation is enhanced by such publications. A major function of universities is the dissemination of information. This has not been lost sight of at Georgia Tech; and while the ratio of publications to total research has declined, we are still publishing as many papers and articles as before we took on a large defense research program--that is, we are keeping up our basic research and we are reporting it.

In spite of the disadvantages I have mentioned, I am, by and large, in favor of sponsored research in universities for the reasons cited earlier. I believe that in times of stress, such as the present, universities must give a more utilitarian type of service than is desirable in peacetime. But I feel strongly that the Government must be careful that it does not apply pressures on the universities which will impair their ability to do fundamental research, for that would be tantamount to draining dry the well into which it and industry must dip for basic knowledge.

Not the least of a university's problems when it decides to take on sponsored research is the development of a plan for organizing its activities and handling contractual details. This can be done in many ways and volumes have been written on the subject. Research has many of the aspects of a business, and the man who heads it up should not only be a scientist in his own right but also an administrator, an executive, and a businessman. He should have an understanding of human nature, a deep sympathy with the research worker, unlimited patience, tremendous energy, a keen financial sense, knowledge, and wisdom. Such men are rare, and a reasonable approximation is all that can be expected.

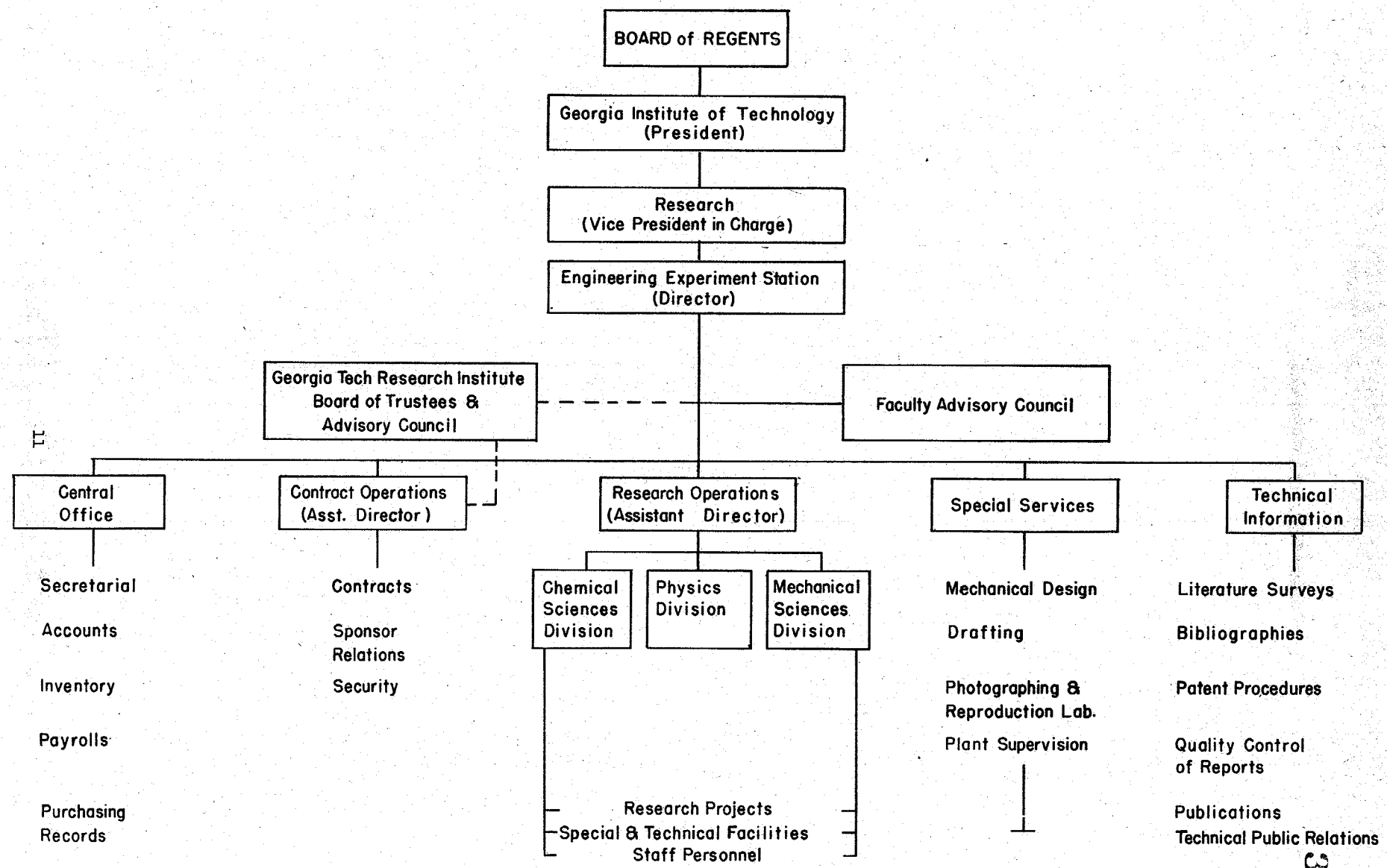
This top administrator should not be loaded with details, and he should have the faculty of knowing how to delegate both responsibility and the authority to carry it out. Scientific research talent being rare, each of the important scientists under the director should be given all the assistants he can use to relieve him as much as possible from detailed duties of a clerical, purchasing, designing, engineering, or technical nature.

While I do not claim that it is perfect, I would like to show you the organization chart of Georgia Tech Engineering Experiment Station to illustrate one way of organizing for handling sponsored research. This chart has been distributed to you and if you will have a look at it now, I will point out to you some of the things.

Start at the top of the chart (organization chart on following page), the basic control in the case of Georgia Tech is the Board of Regents. I might say a word about the Board of Regents. It is made up of 15 men, two of whom are appointed each year for terms of seven years by the Governor and the appointments have to be confirmed by the Senate of the State of Georgia; that makes 14. The 14 elect the fifteenth who is the chancellor of the University system. The reason for this particular setup, which is now written into the constitution of the State of Georgia, was due to some unpleasantness we had in Georgia about 15 or 16 years ago when one governor attempted to gain control and take over the educational system of the state. That is no longer possible. He cannot succeed himself so he can't get control of the Board of Regents until the eleventh month, which is the last month he is in office. The result has been that we have a high type of man on that board--small businessmen, educators, leaders in the state.

Now we have under the Board of Regents the president of the institution who handles a number of things. Then research--the vice president in charge of research also directs the Extension Division Division programs and handles all new projects, such as building and planning programs. Under him is the Director of the Engineering Experiment Station. Then you get down to the men on the firing line, that is the Faculty Advisory Council. I won't go into the way it is composed, but it is set up so that all agencies at Georgia Tech who remotely might be concerned with research have representation on that board. It meets once a year, reviews projects before the institution, and discusses the ways in which things should be done.

Now over to the left you will see--the dotted line--an agency known as Georgia Tech Research Institute. That is a private corporation set up to enable us to handle projects which cannot be


BOARD of REGENTS
Georgia Institute of Technology (President)
Research (Vice President in Charge)
Engineering Experiment Station (Director)
Georgia Tech Research Institute Board of Trustees & Advisory Council
Faculty Advisory Council
Central Office
Contract Operations (Asst. Director)
Research Operations (Assistant Director)
Special Services
Technical Information
Secretarial
Accounts
Inventory
Payrolls
Purchasing
Records
Contracts
Sponsor Relations
Security
Chemical Sciences Division
Physics Division
Mechanical Sciences Division
Research Projects
Special & Technical Facilities
Staff Personnel
Mechanical Design
Drafting
Photographing & Reproduction Lab.
Plant Supervision
Literature Surveys
Bibliographies
Patent Procedures
Quality Control of Reports
Publications
Technical Public Relations

handled through State laws and State rules and regulations. It is a privately incorporated corporation, a third of whose membership are alumni of Georgia Tech, a third are industrial leaders, and a third are members of the faculty of Georgia Tech. It is separately incorporated and handles commercial and sponsored research. One of its chief functions is to promote research and development work with private industry at Georgia Tech.

You see that dotted line connecting Contract Operations. They handle all that work. They handle matters of sponsor relations, security, and so on, which enables us to conduct for private industry work which might require secrecy so that there is never any publication. It is funneled out so that it never gets under the control of the state in any way. Everything is handled separately just as though a private corporation was doing the work. However, they may use and do use the instruments, the labs. and equipment for which they pay. The whole business side of the deal is handled through this Georgia Tech Research Institute. They have a secretarial staff, accountants, inventories, pay rolls, purchasing, and records the same as any other well-organized business concern would have.

Down about the middle of the chart, you see the real meat in the coconut—that is Research Operations. That is the production part of the Research Engineering Experiment Station. Each of those divisions is handled by a director, and the three major divisions at the present time are the Chemical Sciences Division, the Physics Division, and the Mechanical Sciences Division. Those divisions handle research projects and special technical facilities. About 200 full-time people are employed there at the present time.

Over to the right, you will see Special Services which are rendered, such as Mechanical Design, Drafting, Photographic and Reproduction Lab., and Plant Supervision. These photographs were produced by that division, but I must say that we do not have any such service as I saw demonstrated here this morning. I had expected to show you this on a reflectoscope. I found that was not available, but General Vanaman offered to have copies made and in less than 20 minutes we had a reproduction of this chart in your hands, a most remarkable accomplishment. I congratulate you for such an efficient production division.

Finally, we have a Technical Information Division over at the far left. Needless to say, this division has assisted me in preparing this talk. This has gone through a number of hands, has been criticized by a number of people, and these technical divisions assisted me very much in that they make literary surveys, they examine bibliographies, handle all patent procedures,

handle publications. We get out one that is very useful and very interesting called the "Research Engineer," which publishes a list of all the projects which we have going through the laboratory and, from time to time, timely articles about those--that is, provided we are permitted to publish them. As I indicated previously in this talk, we cannot give publicity to a lot of the work we do for the Federal Government and some that we do for industry.

Now continuing with my paper, by this time I hope I have left you with the impression that universities are making definite contributions to the national research effort in basic research, industrial research, and defense research. Specifically of interest to you will be the fact that universities are now conducting about 10 percent of the Nation's 1.1 billion dollar military research program. The Engineering College Research Council recently published the results of a survey which indicates that defense research in universities can be increased by 60 percent without detracting from the present level of nondefense research effort. I won't burden you with all of the data from which this conclusion was derived, but I will explain that of 20,000 faculty members reported by their institutions to be qualified to perform research, 8,000 are not doing so. Putting them to work on research one-quarter time would raise the universities' contribution to 16 percent. At present, each senior faculty member engaged in research directs, on the average, two graduate student assistants. Apparently a way of increasing the Nation's research potential still further is to increase this ratio. The survey, which was prompted by the research manpower shortage, concludes with the statement that it is in the universities that the greatest potential for increasing our national research and development effort lies.

The draft policies adopted in World War II and now again during this war we are waging with Russian satellites have not only siphoned off the younger trained scientists who should form the active research group of tomorrow but also have prevented the training of the graduate students who should form the cadres for the day after tomorrow. And when the armed forces want Reserve officers, they show no mercy to the colleges.

We have on our faculty 72 members who are Reserve officers. They have called 15 or 20 of them already and the others are sitting on the edges of their chairs. They will probably get them sooner or later, too. However, for your information, I don't show any mercy about it either. I say, "If you belong to a volunteer fire department and there is a fire, you must go. If you don't belong to it, all right. But if you do, when the fire bell rings, you go." We don't try to hold them back or discourage them, but the net result is that it is cutting down the defense effort that I have been talking to you about.

The important thought I want to leave with you is that the universities need research and research needs the universities. As Congress becomes aware of this fact, I am sure many of our problems will be alleviated.

It is my hope that this presentation of the problem of the universities in their efforts to aid in these national research undertakings will help you in the important positions to which you will be called in the near future. It is most important that the top-ranking military personnel understand and exercise a sympathetic tolerance toward our universities and their efforts to train scientists and at the same time conduct research on military problems.

Thank you very much for your fine attention.

MR. SWAREN: Dr. Van Leer, on behalf of the entire college, I thank you for a very enlightening talk.

DR. VAN LEER: I could go on talking to this group. It is not often I have the opportunity to talk to such an intelligent group. I usually have to talk to college professors.

(28 Dec 1951—750)S./VJM

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