PRESIDENT'S REPORT ISSUE

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PRESIDENT'S REPORT ISSUE

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KARL TAYLOR COMPTON 1887–1954

President of the Massachusetts Institute of Technology, 1930–1948
Chairman of the Corporation, 1948–1954

M.I.T. alumni the world over remember Karl Compton for his warmth and friendliness; this photograph was made when he and Mrs. Compton joined students in the dormitories for a celebration of the Christmas season last winter.

Resolutions of the Corporation

Possessed of rare qualities of imagination, perception and understanding, Karl Taylor Compton — as scientist, teacher, educational administrator and devoted public servant — demonstrated throughout his life the power and the good of disinterested creativeness.

In the breadth of its intellectual undertakings, in the forward thrust of its researches and in the spirit of common trust and loyalty pervading its people the Massachusetts Institute of Technology is witness of what his creative force accomplished during the eighteen years of his presidency and the six years of his wise elder statesmanship as Chairman of this Corporation. He found M.I.T. an eminent engineering school; he left it a pre-eminent institute of technology of a new and vital sort. Through his wisdom the Institute was consolidated and stabilized in its traditional endeavors, and through his foresight it was given new motivation and direction that fostered its growth and increased its scope in a crucial period. When he came to M.I.T. it had 3,209 students, 563 on the staff and a budget of $3,739,000. When he died it had 5,183 students, 1,595 on the staff and a budget of $46,181,172. He added a School of Science which has flourished. He encouraged and greatly extended the Institute's program of graduate study, and he engendered a humane and liberal spirit which found many embodiments including a School of Industrial Management and a School of Humanities and Social Studies. The extraordinarily successful Technology Loan Fund and many other aids to students owe their inception to him.

The young men and women who come to M.I.T. for the nurture of mind and spirit are the beneficiaries in manifold ways of his forethought and his vision. None who knew him well will doubt that in the prospering of these young minds he found his greatest reward. Let it be remembered that at nearly the last occasion when he talked with an Institute gathering, he spoke of his own first Commencement, when his father had said to him, "Karl, this is the proudest day of my life." He sought to pass on to his hearers that pride which the older man has in the achievement that the younger man has attained.

For the hallmark of Karl Compton was generosity of spirit, the will to share that which he had, of mind, of spirit, of soul; his great gifts of intellect and comprehension he offered freely and readily wherever there was need. Among his colleagues in Faculty, administration and student body he was an example of justice, integrity and candid simplicity. He had a wondrous gift for calling forth the best in other people and for engendering a spirit of good will among all coming within his influence. His personality was free of any trace of guile, a personality emanating goodness and wisdom and always generous and benevolent in human relations. The generosity of spirit which characterized him found natural expression in the friendliness with which he

met the world. Throughout the Institute, his associates from the highest to the humblest knew him as a friend, and it is thus that they hold him in their hearts. As our fellow member, Mr. Ferris, has said, "The beauty of his countenance and the expression of his face was clearly an outward sign of inward and spiritual grace."

The record of Karl Compton's accomplishments as scientist, teacher and public servant is large in the history of our age. The Corporation of the Massachusetts Institute of Technology engrosses that record with pride in its annals, and therein sets down with especial honor these matters that follow.

As a scientist, a follower of the baffling trail of truth, Karl Compton in the years before he was called to administer and guide for the well-being of others had made discoveries which advanced the noble discipline of physics. His published papers recording this achievement total more than a hundred, ranging from discussions of photoelectric phenomena to considerations of spectroscopy in the extreme ultraviolet. From this devotion of his to the advancement of learning in the field of physics grew his conviction of the necessity of consolidation and collaboration in the efforts of scholars in that field and, as a consequence, his achievement as principal creator of the American Institute of Physics. Beyond question, the course of development of physics was furthered and accelerated through Karl Compton's contributions. As one of his colleagues has said, "He was one of science's proudest examples of what a scientist should be and do."

But his work as a scientist was not confined to his accomplishments in research and in the focusing of creative effort. It was in no small measure as a teacher that Karl Compton gave effectively of himself to the advancement of learning. At Reed College and at Princeton University, his power to impart knowledge and, beyond that, to fire learning minds with the urge and the determination to press on with the search for comprehension, is today a proud tradition. At the Massachusetts Institute of Technology the devotion to the truth and its advancement, which in the earlier days had made him an inspiration to students directly, of necessity took its expression in the reshaping and evolving of the institution and its program as a whole. The advances in practice and in philosophy which took place at the Institute in the years following 1930 are the impressive record of the achievements of Karl Compton the statesman in education who had grown out of Karl Compton the teacher in lecture hall and laboratory.

Partly in parallel and partly in sequence with this evolving of the inspired researcher and teacher into the creative guide and administrator in university affairs was the growth of Karl Compton's share in the nation's trials and responsibilities. During the First World War he had engaged in the development of submarine detection devices and had later become an

officer of the Research Information Service and an associate scientific attaché to the United States Embassy in Paris. Between wars, as Chairman of the National Science Advisory Board and in many other capacities, he was an eloquent advocate for putting science to work for the national welfare. When the threat of the Second World War loomed Dr. Compton served as a member of the War Resources Board in 1940. In June of that year he became a member of the National Defense Research Committee, later to be expanded as the Office of Scientific Research and Development. It was through this agency that Dr. Compton gave of his best to the nation during the entire struggle, so effectively that the citation accompanying his Medal of Merit declared that he personally had been responsible for shortening the duration of the war. Directly responsible, as head of the famous Division 14 of the O.S.R.D., for American radar development, Dr. Compton made his counsel and wisdom available in other fields as well, including the development of atomic weapons. Shortly before the end of the war he had gone to the Pacific to direct the Office of Field Service of the O.S.R.D., and when Japan surrendered, as one of the first civilians to reach the island, he led a survey of the status of Japanese military science. In these and many other ways he rendered a vast service to our country.

This judicial capacity of his was to be called upon again in the years after the war when in 1948 he was called to the chairmanship of the Research and Development Board of the National Military Establishment. The statesmanship which produced these wartime calls had its peacetime analogue in the many requests, to which he generously acceded, that he hold posts in government, foundations and public trusts as well as in industrial corporations. Among these should be recited the Ford Foundation, the Rockefeller Foundation, the Sloan Foundation and the Sloan-Kettering Institute.

The Massachusetts Institute of Technology will go forward in accomplishment in the years ahead, expanding science and technology, stimulating the worthy ambitions of youth, serving its country in time of need. It will continue to be a body of scholars bound together in friendly relationship for creative effort. It will proceed on this path with greater assurance and devotion because of the life of Karl Compton and because his inspiration will long endure in our hearts.

In expressing its deep sense of loss in the death of its Chairman, Karl Taylor Compton, the Corporation of the Massachusetts Institute of Technology inscribes this tribute to him and resolves that it be made a part of the permanent record and that copies be sent to his family.

Respectfully submitted

VANNEVAR BUSH
ALFRED L. LOOMIS
GERARD SWOPE
JAMES R. KILLIAN, JR., Chairman

Report of the President

To Members of the Corporation:

Last year in this annual report I presented a restatement of M.I.T.'s long-term policies and objectives, and this blueprint was formally endorsed by the Corporation. With this plan as a guide, I venture this year to take a look ahead, to anticipate some of the responsibilities, opportunities and needs of our institution over the next few years.

First, I would emphasize our share of the national responsibility to maintain a favorable climate for scientific and technological progress.

New Forces Affecting Science. The most insistent and commanding intellectual problem of our period is survival — the defense of the free world against sustained ideological assault and

possible thermonuclear attack. One of the many requirements imposed upon the nation by this brutal fact is an inescapable demand upon scholars and educational institutions to serve the national defense and to strengthen the free world. In this marshaling of the creative resources of scholarship, science and technology occupy a position of great responsibility and difficulty: for out of science have and must come some of the major instrumentalities for the strengthening and the protection of the free world. This may well be one of the most beneficent current services of science and scholarship.

The use of science to aid defense has brought great changes in the scientific life of the nation. Before World War II the expenditures of the Federal Government for science, both within and without the government, probably did not exceed one hundred million dollars. In contrast, the government now spends about two billion dollars a year on research and development, most of it relating to defense. This huge expenditure has made the government the principal sponsor of scientific research in the United States, including university research.

Out of this new condition arise both benefits and hazards. The safety and welfare of the nation are advanced by such research. Indeed a vast research effort is required by government, industry and education for the nation to maintain its military superiority, its dynamic economy and the improvement of the health, the education, and the general welfare of its people.

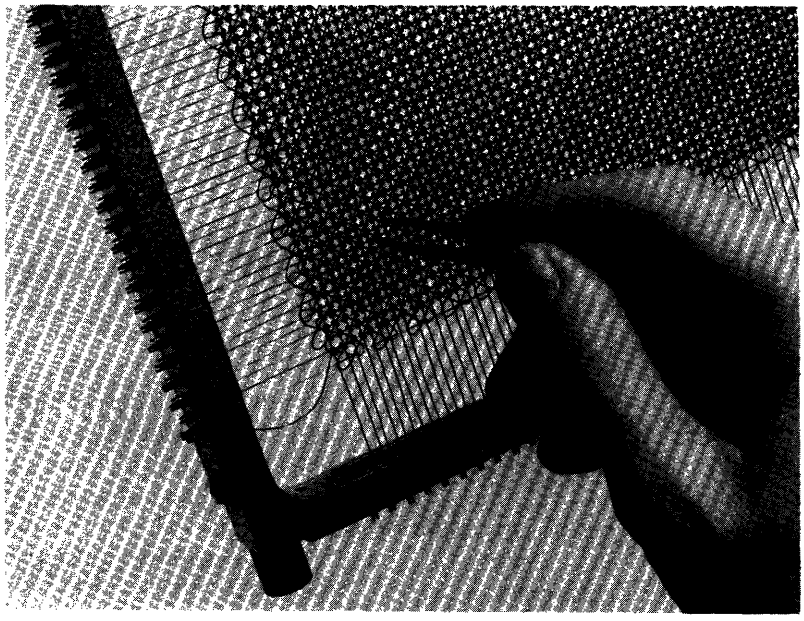
In addition to conducting urgent research, our universities, and especially their scientists, have been called upon to provide advisory services to the government to an extent that has no precedent in this country or any other nation.

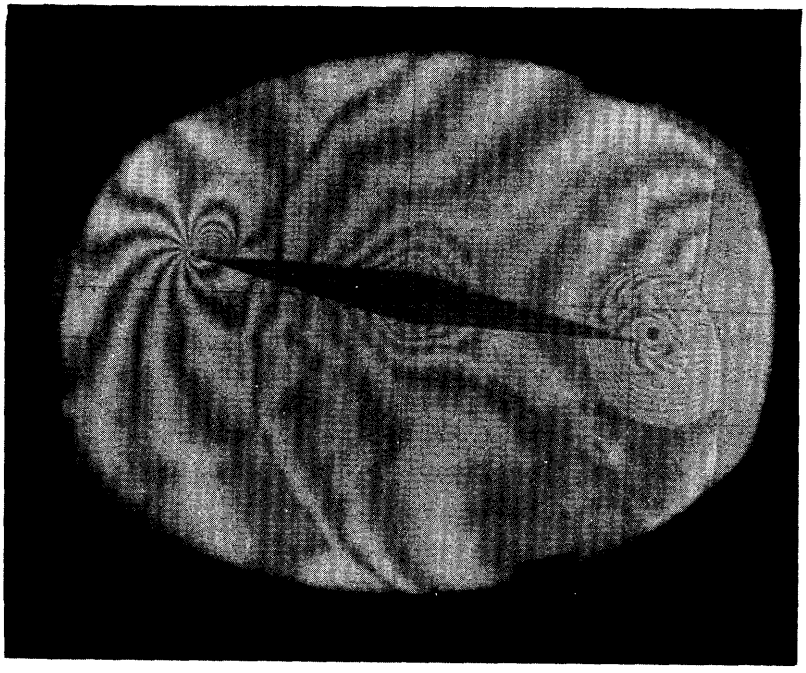
Inherent in the large Federal use of science and expenditure for research is the possibility of encroachments on the independence of science and the freedom of our educational institutions. So far this hazard has been remarkably well avoided; but the hazard nevertheless remains, and constant vigilance and great wisdom will be required to preserve the initiative and freedom of science. Vitally important to the preservation of this freedom are the maintenance of strong private institutions impregnably independent, and the continued support of science by private donors — foundations, corporations and individuals. From these private sources must come "freedom money" and the funds for basic research to help offset the large percentage of government funds earmarked for development.

Another condition that has been highlighted by the demands of defense — piled on top of industry's growing use of research and advanced technology — is the new level of demand for scientists and engineers. The public has begun to realize that a critical shortage of these professionals is hazardous to the nation. In education, in industry and in the highest councils of government, as a consequence, there has been evidence of concern over the scarcity of science teachers for secondary schools and the inadequate number of scientists and engineers being graduated from our colleges.

These are but a few of the factors which have created new problems for science and technology, pointed up their critical importance in the life of the nation and brought new responsibilities to institutions such as M.I.T., involving them deeply in matters affecting national policy and welfare and thrusting them into complex new relationships hardly dreamed of before by educational institutions.

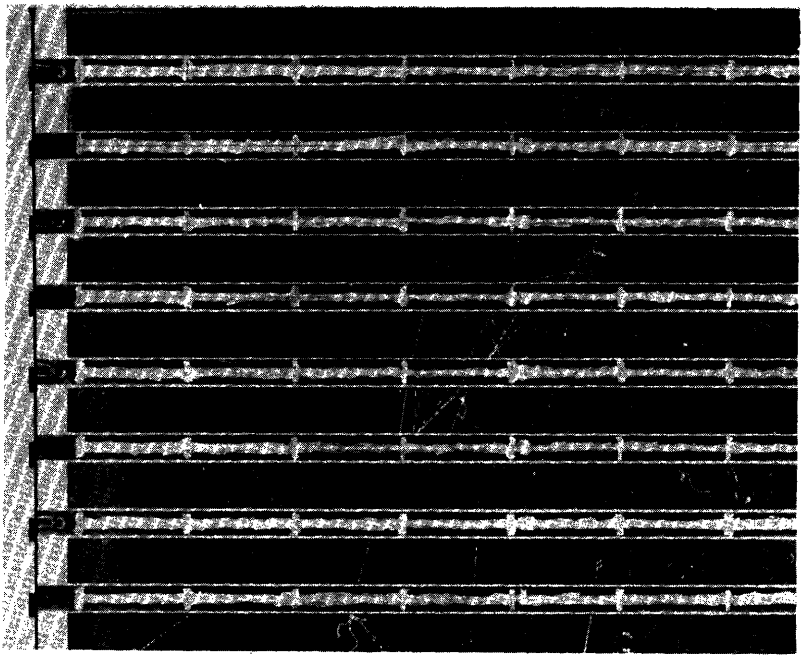
One of the promising developments in electronic computers is this magnetic "memory" unit made in the M.I.T. Digital Computer Laboratory, *using tiny rings of ferro-ceramic material strung on a honeycomb of copper wires. An array of these honeycombs, now in use in the Whirlwind computer, has been so successful as to promise a substantial increase in the speed and reliability of all digital computing equipment.*





The new shock tube in the Department of Aeronautical Engineering has proved itself a valuable research tool — both as a source of shock waves and as a short-duration subsonic, transonic and supersonic wind tunnel for aircraft model testing. This interferogram, a special photograph which makes air flow visible, shows a shock wave at the extreme right just after it has passed an aircraft wing model; in passing the model this flow-initiating shock has created a complex of spiralling flow formations.

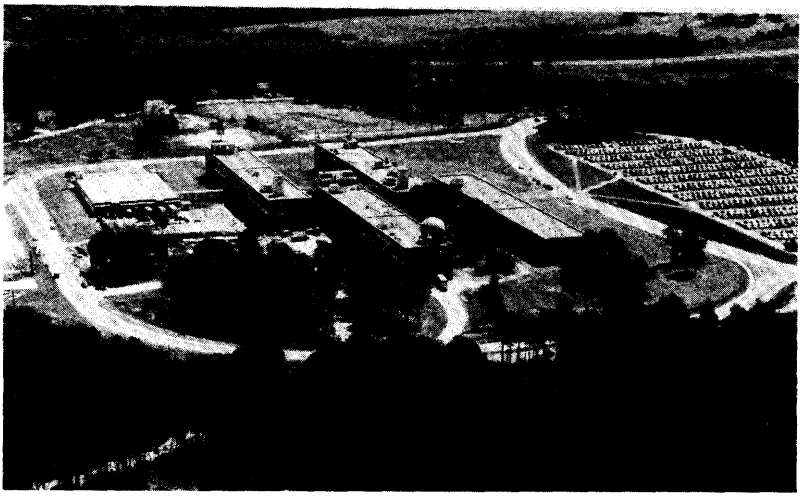
The Beneficent Uses of Science. Along with the growing recognition of the importance of science to the national welfare have appeared adverse reactions to science — reactions of fear, uneasiness and misunderstanding, especially with respect to the work and methods of the scientist. The great and frequently dramatic part that science plays in our defense has resulted in a tendency to identify science mainly with military applications and to think of its effects in terms of destruction. There has been a growing danger that the beneficent values of science would be clouded by these fears and misunderstandings, and recent events have clearly pointed up this hazard.



This photograph, made with a multiple cloud chamber by the M.I.T. Cosmic Ray Group at Echo Lake, Colorado, may be the first to show the long-sought anti-proton. The heavy particle, a cosmic ray component, enters the chamber from above, travels downward and comes to rest in the sixth plate from the top; here it disappears, and three electron showers seem to arise. This is probably an anti-proton — a netative proton which after stopping interacts with an ordinary (positive) proton to transform their combined mass into energy.

One of the responsibilities of M.I.T. in the light of these current conditions is to explain, to demonstrate and to symbolize the beneficent nature of science and of creative intelligence. While discharging to the level best of our ability our responsibilities for defense, we must also keep steadily before us the importance of providing a favorable environment for pure research, for the prospering of disinterested curiosity, for the pursuit of science as a noble end in itself and for the encouragement of creative intelligence.

If American science is to continue to prosper, if it is to continue to attract to it its proper complement of creative and gifted minds, we must everywhere combat the mistaken notion that

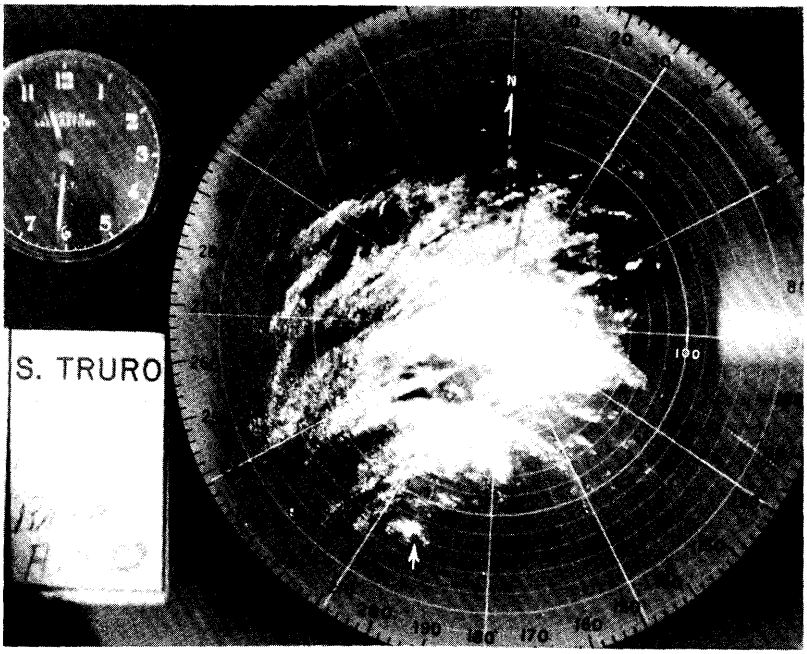


New buildings in Lexington (above), adjoining Bedford Airport, are now the home of the Lincoln Laboratory, the air defense laboratory operated by M.I.T. for the Armed Forces. Project Lincoln also makes use of a number of field stations, including one at Round Hill, the ocean-side estate of Colonel E. H. R. Green at South Dartmouth, Massachusetts. Round Hill (below) has been used for various Institute activities since the 1920's.

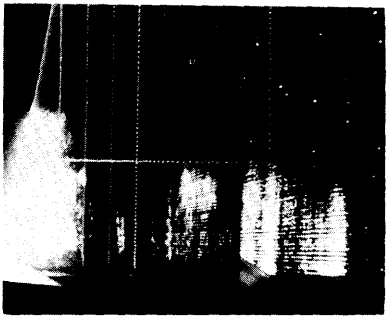
science and engineering are narrow, provincial and destructive of human values. We must demonstrate instead that science and engineering are great liberalizing, humanizing forces as well as the greatest intellectual structure achieved by our civilization, and that the spirit and outlook of science have given and continue to give strength and vigor to the character and spirit of the American people. As Professor F. S. C. Northrop has written, "If one wants to understand the culture of the United States one must look . . . at its universal education in the natural sciences and their skills, its agricultural colleges, technological institutes, and research laboratories. . . . "

In serving the nation's safety and economy and industrial development, men of science and technology at the same time thus serve a deep spiritual need — the need to understand nature and to use it for the welfare of man. The practical benefits of science are a by-product of this urge to understand. Indeed science finds its fulfillment not only in the great practical structures it creates but also in the insights it provides into the order, the majesty and the mystery of man and of the universe. The needs of the spirit are served when we pursue science with these ends in mind — when we prize its practical benefits while keeping steadily in view the soaring structures of thought and beauty that science has slowly been building.

In face of the current turmoil involving scientists and other scholars, it is our continuing responsibility and opportunity at M.I.T. to express with poise and composure the beneficent values of science and all other forms of creative intelligence and to combat the anti-intellectualism which deprecates these values. We have an unusually urgent responsibility now to stress the true character of science as a liberalizing, humanizing and creative force that serves man spiritually as well as intellectually and practically. This responsibility has been implicit and explicit in the plans and program of the Institute since its inception. It is illustrated by developments described in this report. In the immediate years ahead, it is vital that these concepts continue to characterize our program and our education.



More than 8,000 photographs were made of radar screens showing Edna, the second tropical storm to strike New England this fall, by a weather radar network of the Cambridge Air Force Research Center, Hanscom Field (Bedford, Massachusetts), and M. I. T.'s Lincoln Laboratory and Department of Meteorology. A radar "map," above, shows the hurricane's heavy rainfall in circular bands surrounding the eye, as seen from the Project Lincoln radar site in South Truro, on Cape Cod, when the storm center (arrow) was about 125 miles away. A vertical cross-section of the storm, made at about the same time at South Truro by a technique believed new to radar meteorology, shows again the bands of precipitation to the southwest, toward the eye. A 32-hour vigil of radar operations, including that in the Meteorology Department in Cambridge (right, below), surveyed the storm continuously until it moved northeast of Cape Cod.



Educational Trends

It has been remarked that M.I.T. is always changing yet remains forever the same. This is an epigrammatic way of saying that one of the sound characteristics of our long-established objectives and policies is that they require and make possible a constant adjustment of our educational methods to new conditions and new opportunities. In this sense we are witnessing important changes in our classrooms and laboratories that will continue to be marked in the immediate years ahead. These changes reflect not only the current vigor of our Faculty planning and discussion, but also the continuing influence of Dr. Compton's leadership, the effects of the war and the recommendations of the Committee on Educational Survey.

Our academic departments continue to be strong in their independence and initiative. At the same time they are responding to the need for interdepartmental activities and new professional patterns. Many of the important fields of advance in industry, as well as education, now break across conventional academic departmental lines. In his forthcoming report on the School of Engineering, Dean C. Richard Soderberg points up this blurring of the traditional professional pattern of our departments.

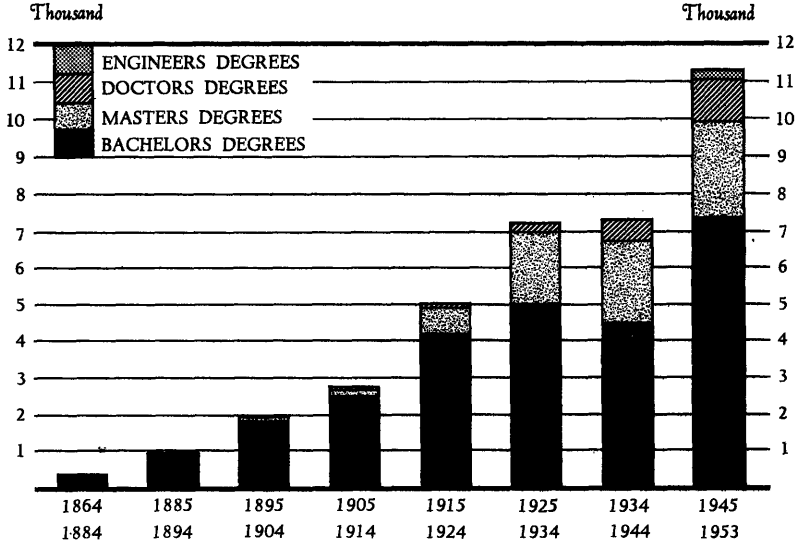
"As this process continues," he observes, "each one of the various departments will continue to respond . . . to the whole external complex of technology. They will thus tend to differ more through methods of approach and emphasis than through different syntheses of sharply defined professional fields. Most of the major subdivisions of applied science will be taught in several departments. The departments will tend to become units of administration through which the initiative of their leading personalities will find expression. This is one of the significant by-products of the increasingly close interrelation between the members of our staff and the world of engineering. . . . It is my conviction that this tendency [as expressed by sponsored research, the Industrial Liaison Program and outside professional work by faculty members], even though it gives rise to baffling administrative problems, is a gratifying sign of strength and healthy development."

In addition to this growing articulation of our program with the professional life of the nation, we are witnessing important innovations and advances in our curriculum and teaching methods. The Department of Physics is in process of reorganizing its laboratory instruction for freshmen and sophomores, and the methods and equipment being developed have created nationwide interest among physicists and engineers, as indeed have other teaching innovations in the Department.

The trend continues of introducing more flexibility into our curriculum, particularly for the purpose of affording exceptional students the opportunity to advance at their own pace. The engineering departments are experimenting with methods for developing engineering judgment and with ways of breaking the traditional and sometimes stultifying sequence of fundamentals followed by applications. The Department of Chemical Engineering, for example, has introduced a new professional senior elective aimed at cultivating engineering judgment and is introducing students in the sophomore year to chemical engineering by giving them an opportunity to participate in a professional prob-

Degrees Awarded Since M.I.T.'s Founding

The graduate school plays an increasing role in academic life at the Institute.



lem illustrative of the methods and concepts of chemical engineers. We continue to witness an increasing emphasis on fundamentals — the injection of more science, for example, into the engineering curricula. This trend also is reflected in the further development of our program in general education.

These trends have all been influential in the major revision which has taken place in our undergraduate electrical engineering program. This new program seeks to provide a broadened and deepened scientific content. It seeks to give the electrical engineer an insight into the design and use of modern materials and to stress the basic unity of all fields of engineering. The system of options in the department has been dropped in favor of a coherent, homogeneous program in subjects fundamental to the broad art of electrical engineering, and new concepts have been introduced into this program in regard to the teaching of energy conversion processes — a part of electrical engineering that has tended to languish in recent years.

This reorientation of our electrical engineering program, which typifies what is going on within the School of Engineering, has created widespread interest in industry. A representative of one of our major electrical manufacturing companies, recently visiting with us at the Institute, indicated that in his judgment something profoundly important had taken place in the education of electrical engineers and that this new program will have not only great influence on industry's own advanced training but on engineering schools throughout the country.

Since the war we have seen important changes in the humanities, social sciences and general education, and we may expect further developments in these fields. The coming academic year may bring a decision on the establishment of a new course of study whose content will be made up of approximately half engineering and half courses in the humanities and social sciences. Dean John E. Burchard and his associates are now working on a plan for the teaching of fine arts as an additional option in the junior and senior years of our humanities program. We foresee the possibility that our Center for International Studies will provide us with new opportunities to prepare engineers for foreign service, particularly the foreign service of industrial companies. If funds can be obtained we have before us a clear need to give a larger place in our curriculum to psychology. Work in this field is now spread throughout the institution with a center in the Department of Economics and Social Science. A distinguished committee of psychologists, who

The musical activities of the M.I.T. Symphony Orchestra, Glee Club, and Choral Society have been extraordinarily popular and successful. This rehearsal in Walker Memorial preceded a performance last winter which reviewers called "an exciting demonstration . . . of a degree of professional excellence that can compete successfully with any in the area."

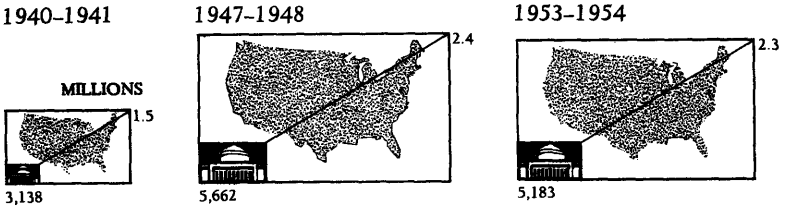
have examined our work in psychology and our needs, has recommended that we create a formal Department of Psychology — a recommendation that is supported by various components of our academic organization but particularly by the School of Engineering. If we are to make additions of this kind to our program we must obtain new funds for their long-term support.

What we are witnessing at M.I.T., along with a renaissance of imaginative teaching, is a new coalition of engineering and science, of science and social science, of education and industry and of general and professional education — a coalition designed more adequately and fully to meet the increasingly complex needs of our society, an education up-to-date in its outlook and relevant in its content to the needs of an industrial civilization. As Professor Arnold Tustin of Birmingham University, England, said last winter in the inaugural lecture of the Edwin Sibley Webster Professorship:

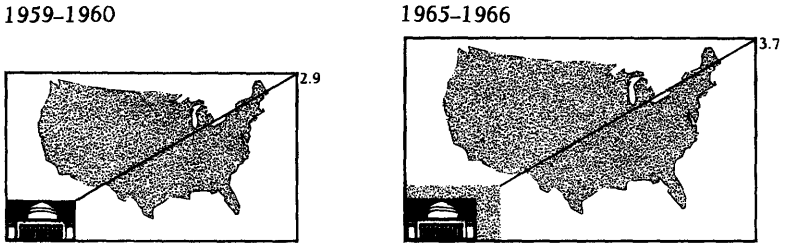
"The conception is taking place that a university for the modern man can and should be built around the teaching of

M.I.T.'s Share of Total American College Enrollments

The Institute has grown apace with the national college attendance.



Should it try to keep pace in the years ahead?



applied science as its core and that it is possible, and indeed likely, that M.I.T. may become the prototype of this new kind of university."

Certainly this concept is implicit in all that is taking place and that will take place here in the immediate years ahead.

How Many Students? Along with other colleges and universities, M.I.T. will be affected by the greatly increased numbers of applicants who will soon be seeking admission to college. The number of pupils already enrolled in our grammar and secondary school system make it clear that a great wave of applicants will hit the colleges by 1960; and that the numbers wishing to enroll in post-high school institutions will be markedly increased and may possibly double in the next fifteen years. As a result the United States is faced with the vast requirement of almost doubling the capacity of its system of education. If it is to provide the same number of facilities per student throughout the country as it does today, this will mean that there will have to be built as much college plant in the next fifteen years or so as has been built in this country in the past three hundred.

It is our present feeling that M.I.T. has many responsibilities to assume in helping to meet this national growth in college enrollments but that our primary responsibility is to maintain high standards and educational leadership. We will not be able to do this if we permit ourselves to grow too large. It is the consensus of our Faculty and administration at the present time that without a marked change in structure and a great increase in resources, we cannot grow appreciably larger in enrollment at the Institute and still maintain the standards, the leadership and the opportunity to pioneer and innovate which have always characterized M.I.T.

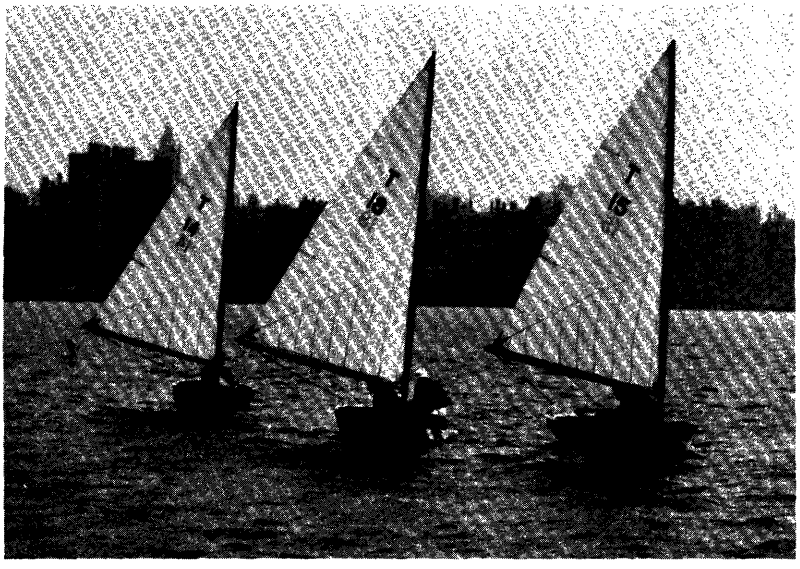
I feel it important that we accept our share of the responsibility of meeting the impending critical shortage of teachers of science in the secondary schools and of steadily refining and advancing our own educational program for the purpose of setting standards for our kind of education throughout the country.

Financially we cannot justify an increase in enrollment without increasing our permanent funds. This is particularly true if M.I.T. is to have the stability of support and the working capital required to undertake the wide range of public service it is now asked to carry. In 1940 our endowment per student was $21,000. Because the growth of our endowment has not kept pace with infla-

tion or with increasing enrollment, this figure has dropped to $10,000, if we adjust for the changed value of the dollar. The immediate effects of greater tuition income as a result of increasing enrollment are, in the long run, illusory, because the enrollment increase invariably creates new capital requirements not immediately felt.

Current proposals for changes in the Internal Revenue Act to permit a deduction for the cost of education might permit colleges to increase tuition without creating a discouraging burden for parents and thus through tuition to cover a greater portion of the total educational cost per student.

Two of the outstanding international trophies reside at M.I.T. this year. After winning the 1954 National Intercollegiate Sailing Championship in California in June, M.I.T.'s sailors successfully defended the international Sir Thomas Lipton Memorial Trophy against an Oxford University team in September on the rain-swept Charles (below). Earlier in the summer the M.I.T. lightweight crew, victorious in the Eastern Association of Rowing Colleges, won the Thames Challenge Cup at Henley-on-Thames, England. In the finals of the Royal Henley Regatta (above), M.I.T. decisively defeated the British Royal Navy team.



Buildings and Campus

Even though we do not enlarge the size of our student body in the years ahead, we will still need additional facilities to round out our program. During the past five years we have gone through a period of building — the greatest, in fact, since M.I.T. moved to Cambridge. In 1948 the value (at cost) of our educational plant totaled nineteen and one-half million dollars. At the end of this year, the value will stand at over thirty-four million dollars. This building program has largely provided for the new and modernized educational and living facilities we need, but an institution such as M.I.T. inevitably finds that the obsolescence of educational facilities in science and engineering is very great and that perhaps more than most institutions we have a problem of keeping up to date.

I hope that we may be able to include in the Compton Memorial Laboratories (see below) a lecture hall seating about 400, so that we can more efficiently schedule the lecture sections in chemistry and other basic sciences. I look forward further to the development of our West Campus along the lines that have been so well conceived by our Planning Committee. We need an adequate Student Union, to be located on the West Campus, and an able committee of students has just recently presented an admirable report specifying what this student union should contain. It is interesting that they proposed that it be a combined Student Union and Alumni Center. The Executive Committee has just authorized studies looking toward permanent apartment houses for married students to replace the present temporary structures we know as Westgate and Westgate West. It is clear that we will continue to have a large number of married students. At the present time one-fifth of our student body is married. By building multi-storied housing for married students we can release land now inefficiently used, and with the land so released it will be possible for us to invite fraternities to build houses on the campus, to move our playing fields westward and enlarge them and to provide urgently needed parking space nearer the central part of the Institute. All of these changes and improvements I hope we can get under way

in the next five years. And with their accomplishment, our campus and over-all facilities for working and living will admirably fulfill our objectives of being a residential college planned to promote high standards in working, living, and playing.

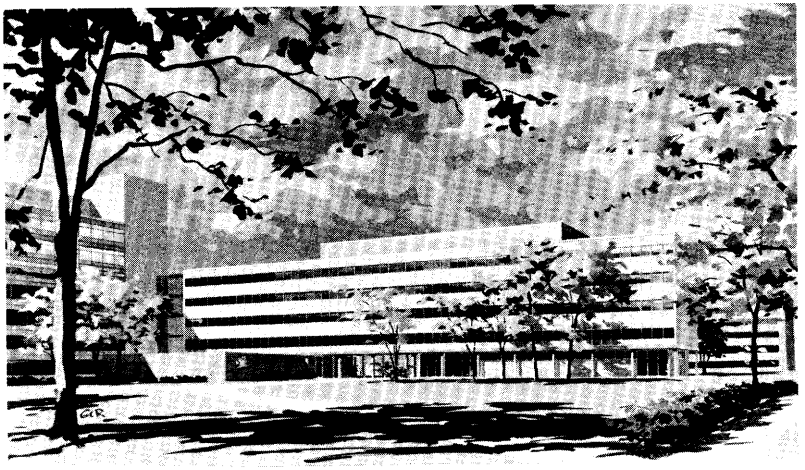
As we add to our plant and to our educational program we are mindful of the advantage of concentrating our resources on our well-established limited objectives as an institute of technology. What we really seek in our new programs and facilities is the adequate and logical implementation of our traditional objectives, not the addition of new objectives.

Facilities for Nuclear Science and Electronics. For the past five years the top priority given any physical need of the Institute has been a building to bring together our teaching and research facilities in electronics and in nuclear science, which are now widely scattered and atrociously housed in temporary buildings built for wartime activities. At Commencement I announced the decision of our Executive Committee to undertake a concentrated special gifts campaign to build this building, and in addition to build an unclassified nuclear reactor for educational use.

The last Executive Committee meeting over which Dr. Compton presided authorized this effort, and he advocated the program with enthusiasm and a sense of urgency. Following Dr. Compton's death Alfred P. Sloan, Jr. '95 and then others independently proposed that the nuclear science and electronics laboratory be built as a memorial to Dr. Compton.

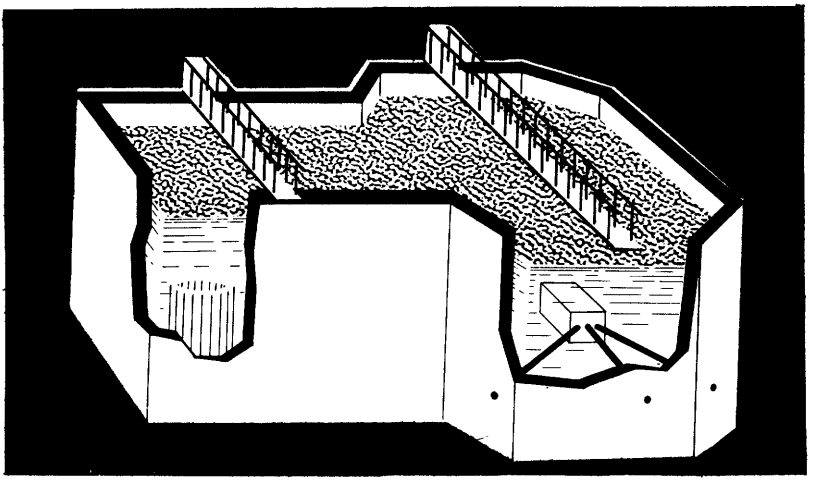
Under the joint leadership of Mr. Sloan and of Marshall B. Dalton '15, its Honorary Chairman and Chairman respectively, the Development Committee of the Corporation is actively planning the campaign to provide capital and operating funds for these two facilities.

Among the many reasons leading to the decision to build an unclassified nuclear reactor is the conviction that the development of atomic energy for beneficent use is important to the spirit of America. Though we must build bombs in a world out of joint, we will move ahead into a better time only by improving the lot of mankind and addressing ourselves to more noble ends than atomic might. The use of science for defense is necessary and we cannot be strong without it. But such use of science and technology is not a natural or satisfying use and in the end can only thwart and distort their true spirit. Is it not possible that bold and imaginative



This new building for nuclear science, nuclear engineering, and electronics — as envisioned by Skidmore, Owings and Merrill, architects of New York — will stand as M.I.T.'s tribute to Karl Compton. It will provide urgently needed new quarters for the Laboratory for Nuclear Science, the Research Laboratory of Electronics, and related work in the physical sciences.

In the "swimming pool" type of nuclear reactor such as is planned by M.I.T., the water pool serves as both shield and coolant. Fission takes place in the core of the reactor, at the right, where neutrons are produced. Some of these neutrons stream through beamholes for use in experiments outside of the reactor; others are used near the reactor core. Gamma-rays are emitted both by the core and by the spent fuel elements suspended in the pool on the left.



acts by Americans to demonstrate the moral purpose and the non-military uses of science and technology can contribute to our own reassurance and to our leadership of a world seeking peace? Our great resources of intelligence, imagination, ingenuity and risk-taking spirit are moral forces that can lead a world out of a cold war. Science, with its spirit of creativity, its search for understanding, its dependence upon freedom and good will and its world-wide currency, offers an avenue to a higher standard of living for all the world, but more importantly, to a resurgence of a spirit of reconciliation and good will among nations. In this period of cold war we are engaged not only in an atomic armaments race but in a race to apply atomic energy to peaceful and beneficial use. This is a race we must win not only for our own welfare but for our influence in the community of the free world.

The Auditorium and Chapel. On May 8, 1955, we plan a dedicatory program for the auditorium and chapel made possible by a grant from the Kresge Foundation. A committee including students and faculty and headed by Dean Burchard is planning the dedication.

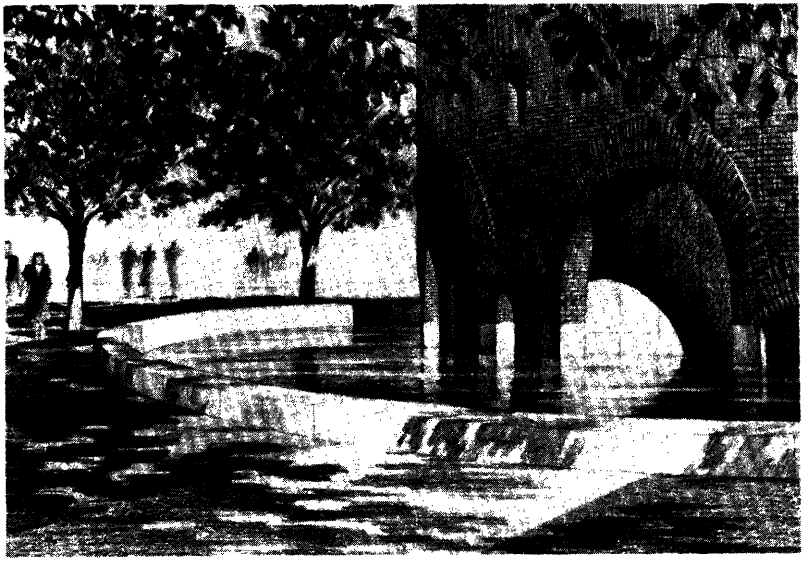
Policies governing the use of the auditorium have been formulated by a committee headed by Professor Howard R. Bartlett. Our use of the chapel is being given careful study by Dean William Speer and others. Without anticipating their recommendations, which will deal directly with actual details and programs, let me state some general considerations which will underlie our policies and program for the chapel.

Our Religious Program

An institution which embraces general as well as professional education must give attention to man's spiritual life — to the place of religion in man's history, in contemporary society and in the life of the individual. It also must encourage an understanding of those postulates which underlie our society's concept of virtue — the unifying ideals and standards, the moral and ethical beliefs which men in general agree upon but reach by diverse paths of faith, philosophy or social pressure. The responsibility to deal with these great matters is inherent in any program to educate young people adequately and broadly. Their all-round development requires a growth of the spirit as well as the mind.

How does a secular institution such as M.I.T. handle this responsibility properly? It does so by maintaining an atmosphere of religious freedom and, within this environment of freedom, by providing adequate opportunity for its students to deepen their understanding of their own spiritual heritage and freely to pursue their own religious interests and to worship God in their own way. Certainly it must avoid advocating any creed or theological doctrine. While partaking of the Judeo-Christian traditions and postulates of American society, a private secular institution must at the same time embrace our tradition of religious tolerance by being equally hospitable to all genuine religions, creeds and personal convictions. Its institutional policy must be one of equal opportunity for all beliefs and outlooks, which means not only that it must express no bias toward any creed but also that it must not exhibit any bias toward religion itself. A private secular institution should be hospitable to religion and to the pursuit of spiritual matters by men of all creeds and differing outlooks, but it should not permit itself to be used to advocate or deny any theological doctrine or any philosophical position toward religion. Our responsibility is to provide opportunity, in a manner wholly elective, for the development of spiritual maturity and the exercise of spiritual interests.

This drawing of the exterior of the new chapel now under construction shows some of the appeal of the unconventional designs conceived by Eero Saarinen, architect of Detroit. The chapel and auditorium, both made possible by a gift of the Kresge Foundation, will be completed for dedication next spring; the 1200-seat auditorium will be available by late this fall.



The small devotional chapel which we are building at M.I.T. has been conceived and will be used in accord with these principles. It will be in the completest sense non-sectarian, equally available to individuals and groups of all faiths. Its purpose is two-fold:

First, to stand as a symbol of the place of the spirit in the life of the mind and as a physical statement of the fact that M.I.T. has a right and a responsibility to deal with ideals as well as ideas and to be concerned with the search for virtue while we become proficient in the search for things.

Second, to provide ready opportunity for students and other members of our community to worship as they choose, to have on campus a building, beautiful and evocative of reverence and meditation, where those who wish may enter and worship God in their fashion.

This two-fold purpose of course includes the provision of opportunities for the separate faiths and groups to use the chapel each in its own way so long as this does not require special privilege. It also means that the chapel will be available for appropriate ceremonies such as marriages and other rites. The chapel will not embrace the full responsibilities of a church and thus will not compete with the neighboring churches which serve members of our community.

I share the hope that the chapel may serve to encourage a creative approach to matters of the spirit. As I have already suggested, an institution of science may well be an environment especially favorable to deeper spiritual insights. More important than its practical achievements are the spiritual contributions of science, its emphasis on the importance of truth and of the value of brotherhood and its revelation of the beauty, the order and the wonder of the universe. Through these contributions it shares with the great faiths opportunities for furthering man's spiritual understanding; and creative minds and spirits, availing themselves of the resources of both science and religion, may advance man's search for virtue and understanding with new vigor and in new ways.

The chapel is in this sense but a part of a broader spiritual program long evolving at the Institute. The future direction and method of this program must rest upon community acceptance and desire, and coordinate with our developing program in the humanities and social studies. It should grow naturally out of the spiritual values which are inherent in our institution. We should remember

that M.I.T. was founded by unselfish men for altruistic purposes and that it has always been an implicit expression of high moral purposes and standards. As a consequence we have a community held together by a humane and tolerant spirit of mediation, reconciliation and reverence for the individual, a community governed by a passion for truth, freedom of inquiry and a preoccupation with ideal aims. We have a community generous in its opportunities to live and let live; a community where men of many faiths and backgrounds are free to interact on each other; a community committed to the ideals of professional service, of ministering to the public, of advancing learning and creating beauty.

These are the spiritual bonds that hold together our society of scholars. Our developing spiritual program, to be valid, must embrace them, exalt them and be consonant with the environment they have created.

The M.I.T. Community

THE PROFESSIONAL RESPONSIBILITIES ASSUMED BY MEMBERS of our Faculty and staff, and the list of the visitors who come to the Institute, constitute together an impressive supplement to the records of the Institute's contributions each year to science and technology. A survey of Faculty and staff activities, for example, suggests that at least 125 positions on national professional boards, panels, and committees were filled by members of this M.I.T. community during the past year. At least 24 major medals and awards for personal achievements came to members of the staff and Faculty during 1953–54. In addition, more than 30 held elective offices in national professional societies and their local chapters, including the American Academy of Arts and Sciences (Dean John E. Burchard, President), the Operations Research Society of America (Dr. Jacinto Steinhardt, President), the American College Health Association (Dr. Dana L. Farnsworth, President), and the Federation of American Scientists (Professor M. Stanley Livingston, Chairman).

A survey of our alumni shows that they, too, extend this influence of M.I.T. upon scientific and professional affairs. In one recent year M.I.T. graduates held the presidencies of at least twelve national societies — including, for example, the Society of Automotive Engineers, the American Society of Mechanical Engineers, the Illuminating Engineering Society, and the Institute of Food Technologists.

The Registry of Guests, which is responsible for official hospitality to all professional visitors who come to M.I.T., reports a total of nearly 1,200 such guests during 1953–54. Of these 174 came from 30 foreign countries, including such relatively uncommon names as Chile, Denmark, Formosa, Israel, Indonesia, Portugal, South Africa, Spain, Syria, and Thailand.

Many professional groups honor us by coming here for conferences and visits. Among these, during 1953–54, were the Massachusetts Association of Women Lawyers, the Massachusetts Public Health Service, the fall meeting of the National Academy of Sciences, the National Council of Independent Schools, the American Society for Quality Control, the Editors' Conference of the McGraw Hill Publishing Company; several sections of the

American Association for the Advancement of Science, the New England Conference on Graduate Education, the National Association of Science Writers, the Massachusetts Science Fair, the National Editorial Writers' Conference, the national convention of the American Institute of Architects, the Japanese Aeronautical Research Mission, the Association of Collegiate Schools of Architecture, and the Mathematics Institute of the Association of Teachers of Mathematics in New England. Boston and New England sections of the national professional societies are frequent visitors throughout the year.

Among our longer-term guests this year have been a number of distinguished visiting professors. Arnold Tustin, head of the Department of Electrical Engineering at the University of Birmingham, England, held the first Edwin Sibley Webster Professorship in Electrical Engineering and delivered a distinguished public lecture to mark the inauguration of this Webster Chair. Four visiting professors in the Department of Economics and Social Science were associated with research in the Center for International Studies: Dr. Everett E. Hagen, formerly economic adviser to the Government of Burma and chairman of the Department of Economics at the University of Illinois; Dr. Benjamin Higgins, formerly monetary and fiscal expert with the National Planning Bureau of the Indonesian Government; Dr. Wilfred Malenbaum, formerly chief of the Investment and Economic Development Staff in the Department of State; and Dr. Paul N. Rosenstein-Rodan, formerly chief of the Economic Advisory Staff in the International Bank for Reconstruction and Development. Dr. Don M. Yost, professor of inorganic chemistry at the California Institute of Technology, held the Arthur D. Little Professorship in Chemistry for the first half of the 1953–54 academic year, and Dr. Alexander R. Todd, a distinguished professor of organic chemistry at Cambridge University in England, has come to hold this Chair during the first part of the current year.

The M.I.T. community continued to grow this year, and the total of Faculty, staff, students, and other personnel here — about 11,500 — by a small margin was the largest in the Institute's history. This reflects in part the continued growth of the Division of Defense Laboratories including the Lincoln Project. Our community also included several hundred students in the Lowell Institute School, among whose 100 graduates at the end of the year was Mrs. Robert Davisson, the first woman to complete work in the School.

Faculty and Administrative Changes

The key importance of the Chairman of the Faculty in our educational planning and policy-making has become increasingly apparent in recent years, especially through the effective leadership shown by recent chairmen. This past summer Professor Edwin R. Gilliland of the Department of Chemical Engineering completed two years of distinguished service in this post, and I bear testimony to the wisdom with which he led the work of the Faculty and represented its interest and that of the Institute. Under his chairmanship and with the effective participation of its several committees, the Faculty, as the Institute's principal policy-making body, worked during the year with unusual vigor and stimulating debate to advance our educational objectives.

As successor to Professor Gilliland, the Faculty has elected Professor Martin J. Buerger of the Department of Geology and Geophysics to be its chairman. We welcome him to our councils.

I described in my report last year certain changes in our administrative organization, and particularly the encouragement given to the decentralization of our administration. During the past year we have moved still further to decentralize our top administration with the appointment of Admiral Edward L. Cochrane as Vice President for Industrial and Governmental Relations. In his new post Vice President Cochrane, who had served as Dean of Engineering since 1952, is concerned with the whole range of the Institute's responsibilities to industry and government. He is serving to coordinate and to give administrative support to the special research and advisory activities undertaken for industry and government, both national and local, and he is assisting the President in discharging the executive responsibilities for this program. Creation of this new vice presidency permits Dr. Julius A. Stratton, who is Vice President and Provost, to devote his primary attention to the Institute's educational program. In Dr. Stratton, Admiral Cochrane, and Mr. Joseph J. Snyder, Vice President and Treasurer, the Institute has three corporate officers of

exceptional understanding, loyalty and capacity. They insure an administration harmonious in action and skilled in supporting the Faculty and other administrative officers.

To succeed Admiral Cochrane in the key post of Dean of Engineering, the Institute is most fortunate in securing Professor Soderberg who, as Head of the Department of Mechanical Engineering, has demonstrated outstanding qualities of professional and academic statesmanship. He brings new strength and wisdom to our administrative team.

With the growth in the size of the Institute and the resulting change in its administrative organization it has become clear that the organization of our councils and other liaison groups in the administration could be improved to bring about better coordination of our efforts and better communications generally. Accordingly, three new councils have been set up, each under the chairmanship of a vice president. There are included in the membership of each council the principal administrative officers in the respective areas of responsibility of the vice presidents. Also, we have made certain additions to the membership of the Academic and Administrative Councils, of which the President serves as Chairman, in order to bring about a better coordination of effort on the part of our chief administrative officers. The Academic Council, the central coordinating administrative group, includes the academic deans, the Dean of Students, the Dean of the Graduate School, the Chairman of the Faculty, the three vice presidents, the Executive Assistant to the President and the President.

Other important changes in our administrative organization included the appointment of Mr. Robert M. Kimball as Secretary of the Institute. Mr. Kimball succeeds Professor Walter H. Gale, who asked to be relieved of administrative duties to devote full attention to plans for future development at the Institute. In his new post, Mr. Kimball is working with the Secretary of the Corporation and its committees to further new undertakings of the Institute. He has special responsibility for relationships with the various departmental visiting committees and for the Committee on Development. Professor Gale will also continue a close association with these projects.

Upon the recommendation of Vice President and Treasurer Snyder, Mr. Paul V. Cusick and Mr. D. L. Rhind were appointed Assistant Treasurers, and Mr. W. A. Hokanson was appointed Bursar to succeed Mr. Rhind. The Executive Committee approved the establishment of two new posts at the Insti-

tute, the Director of Physical Plant and the Director of General Services. Mr. Carl M. F. Peterson has been appointed Director of Physical Plant and Mr. R. Colin Maclaurin, a son of our former President, Director of General Services.

Following Professor Soderberg's appointment as Dean of Engineering, Professor James Holt, Executive Officer of the Department of Mechanical Engineering, became Acting Head; later in the year Professor Jacob P. Den Hartog, who is widely known for studies in applied mechanics, was named to be in charge of the Department.

Other major administrative changes during the year included the appointment of Philip A. Stoddard as Associate Placement Officer; John W. Sheetz to succeed Mr. Stoddard as Assistant to the Director of General Services; Bruce F. Kingsbury as Executive Secretary of the Educational Council; Dr. J. Francis Reintjes as Director of the Servomechanisms Laboratory; and Dr. George E. Valley, Jr., as Associate Director of the Lincoln Laboratory.

Upon the retirement from active duty of Colonel Charles F. Baish, Colonel Charles M. McAfee, Jr., became head of the Department of Military Science. Dr. Dana L. Farnsworth has resigned as Medical Director, having developed here a vigorous and effective health program for our entire community, and Dr. James H. Means has become Acting Medical Director.

The Institute lost an extraordinarily effective administrator and a well-loved teacher in the passing on February 16, 1954, of Professor Ronald H. Robnett, Associate Dean of the School of Industrial Management.

I must also record with deep sorrow the deaths during 1953–54 of four members of the Corporation, all devoted friends of the Institute: Joseph W. Powell, Senior Member of the Corporation; Henry E. Worcester, whose helpfulness and loyalty cannot be measured; Emeritus Life Members Pierre S. duPont and William S. Newell. Expiring Alumni and Term Memberships lost us the association of Rudolf F. Haffenreffer and George J. Leness, but Ralph Lowell and Robert T. Haslam were elected Life Members. Theodore V. Houser, Chairman of the Board of Sears, Roebuck and Company, Chicago, joined our ranks as a Special Term Member, and Horatio L. Bond, Chief Engineer of the National Fire Protection Association, Boston; Ray P. Dinsmore, Vice President of the Goodyear Tire and Rubber Company, Akron, Ohio; and William J. Sherry, oil producer of Tulsa, Oklahoma, as Alumni Term Members.

We are pleased to welcome these new members and look forward to a happy association with them.

Two faculty appointments in the School of Industrial Management require special mention: Professor Billy E. Goetz, widely known as teacher and management consultant in the midwest, came October 1 as Professor of Industrial Management; and Dr. Douglas M. McGregor returns to teaching at M.I.T., as Professor of Industrial Management, after several years' service as President of Antioch College. Two professors have reached the Institute's mandatory retirement age: Professor John B. Babcock in civil engineering, who will serve as lecturer in the department next year; and Professor Gordon B. Wilkes in mechanical engineering. There is a warm spot for both in the hearts of a host of M.I.T. alumni, and we in Cambridge shall miss their wise counsel and friendly association.

Special Faculty Benefits

To improve the economic status of our Faculty and staff a number of steps have been taken in recent years to extend and strengthen supplementary benefits. The Institute's contribution to the Teachers' Insurance Fund has been increased to benefit the Pension Association retirement plan and Social Security has been adopted for all employees. This past summer the Executive Committee approved a revised group life insurance program for the Faculty which doubles the amount of such insurance available. Thus we have already brought our supplemental benefits to a level that compares favorably with any other institution.

Chief among the goals in the period ahead should be further improvements in the economic status of our academic staff. Under the chairmanship of Professor H. Guy Stever, the staff group of the Staff-Administration Committee recently made a study of the Faculty Children Tuition Exchange Plan and recommended participation by M.I.T. This recommendation has been accepted and the Plan is in effect. It provides, subject to certain limitations, for full tuition remission for the children of our Faculty as students at M.I.T. or at sixty member institutions. Blue Cross and Blue Shield protection is available to all our employees on a contributory basis and the Institute's Medical Department continues to provide medical service to all Institute personnel at less than full cost.

Television reporting of work at the Institute is helping us to meet our obligations for public service and education but is making increasing demands for time and resources which pose a severe problem for our Faculty and staff. Here the cameras of the Yankee Network visited a jury session in the Department of Architecture.

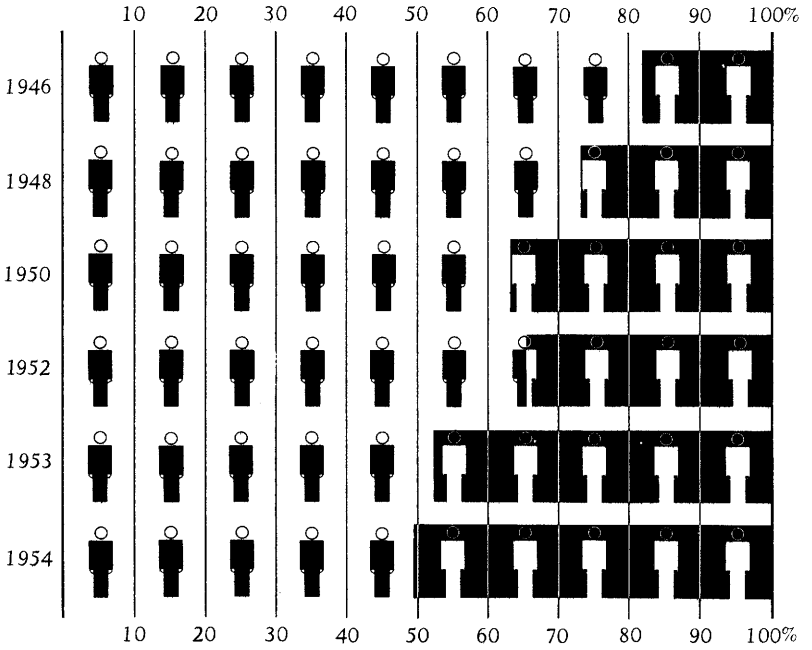
Unsolved Problems—Unfinished Business

This past summer the Academic Council of the Institute met over the period of a week to discuss our program for the coming year, and as a result each administrative officer at the Institute has before him a list of objectives which fall within his cognizance, all being part of an agreed-upon set of overall objectives. Out of this agenda of unfinished business and impending effort let me draw further items not already mentioned in this report.

The Director of Admissions, Professor B. Alden Thresher, has called attention to the increasing rate of cancellations on the part of those admitted to the Institute—students who are accepted but never come. Fifty-eight colleges, replying to a questionnaire circulated by Professor Thresher last year, indicated that the average shrinkage in students who were admitted by these institutions but who did not come was 35 per cent in 1953. The Institute's shrinkage is running higher than this at the present time and has been as high as 48 per cent. One of the principal reasons for this low "yield" in freshman registration has been the tendency of applicants to apply to more than one institution and then to wait until the last minute to make a choice. There is no easy way to meet this problem, and perhaps the burden of handling so many applications will be eased only by encouraging better counseling in the secondary schools. Nevertheless the problem is an acute one for the major institutions of the country, particularly those whose prestige tends to encourage a large number of applications.

Cancellations of Admitted Freshmen

The growing proportion of students who do not come complicate planning and tax admission facilities.



These admitted freshmen enrolled. *These admitted freshmen did not come.*

Another problem associated with admissions is the growing competition among applicants for scholarship assistance. Increasing numbers of applicants for admission are shopping about to see where they can get the greatest financial assistance. The situation is not a healthy one for the colleges and universities. Here again we have found no ready solution, but I am glad to report that the Institute is joining with many of the colleges and universities in the "College Scholarship Service" under the sponsorship of the College Entrance Examination Board. Through this agency an

effort will be made to centralize, on a uniform basis, information about the family resources of freshman scholarship applicants and other information bearing upon the need for assistance.

This fall the total number of scholarship requests from applicants for our freshman class reached 2,000. We have made gratifying progress in augmenting our scholarship resources, but our funds for this purpose are still inadequate. There are areas, both graduate and undergraduate, where our scholarship assistance is wholly inadequate. These include biology, geology and architecture, and in my judgment these important fields suffer because of the general shortage of funds throughout the country for students who wish to study in them.

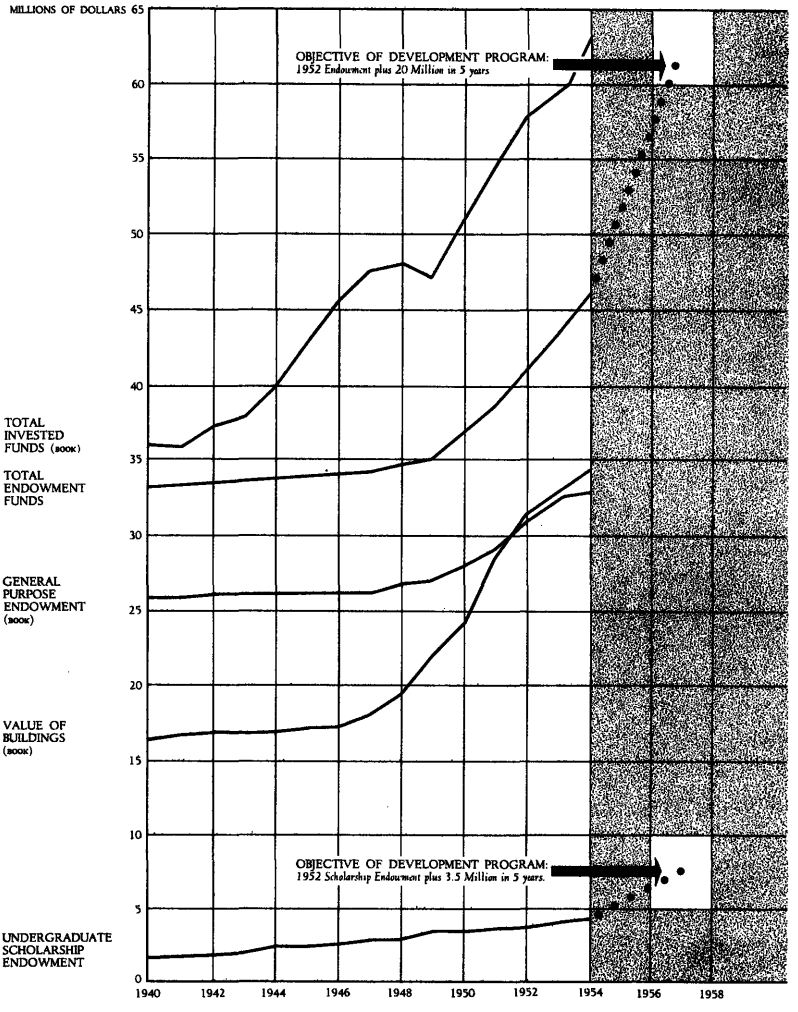
Corporation visiting committees have made numerous recommendations for expenditures in behalf of academic departments which we have so far been unable to cover. These include $40,000 for the completion of essential equipment in the Hydrodynamics Laboratory, $50,000 for equipment in the Food Technology Laboratories, and $75,000 for equipment in the Metals Processing Laboratory. I have spoken elsewhere of our need for funds to establish a solid program in psychology and also of our need for "freedom money" to enable members of the staff to do those valuable things which cannot normally be charged to available funds but which will contribute to their professional development.

One of the most critical needs in a specific field at the Institute is for more adequate financing of our Department of Food Technology — a department which is now too dependent upon current funds. Indeed, we have many such enterprises at the Institute which are too dependent on current funds for support. In the immediate years ahead we must seek to secure funds to insure more stability for their activities. This is one of the reasons why I stress year in and year out the need for increased endowment. I do not contend that endowment is the whole answer to our financial problem or that we should seek to be relieved of the responsibility of demonstrating year in and year out that we can justify current support; our problem is, rather, that the Institute in its rapid development during recent years has outgrown even the minimum amount of endowment that it should have to provide the necessary stability and particularly to cover its permanent tenure commitments.

In reporting to you the ways in which we are progressing, I must also record the above samples of how we have thus far failed to achieve numerous objectives.

The Growth of Endowment and Plant Value

To realize its new opportunities, M. I. T. must have increasing endowment resources.



Statistics of the Year

THE STUDENT BODY NUMBERED 5,183 IN 1953–54, AS compared with 5,074 in 1952–53; the estimated enrollment for 1954–55 is 5,330. Six per cent of last year's total were veterans, compared with 7 per cent the previous year; 20 per cent were married, compared with 16 per cent in 1952–53. One hundred and three women were enrolled, 38 of whom were graduate students. Foreign students numbered 596, and they represented 76 foreign countries.

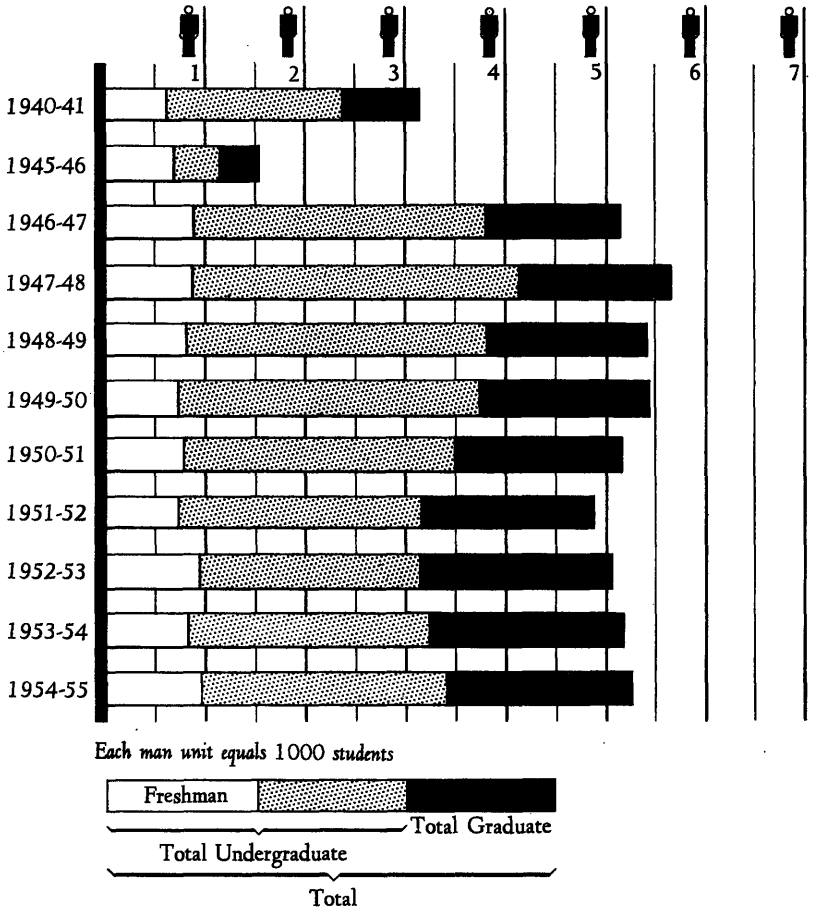
Enrollment in the Graduate School reached a new high of 1,955, compared with 1,879 the previous year. There were 189 officers from the Armed Services enrolled for advanced degrees, in addition to 22 who registered as special students.

Students enrolled at M.I.T. during 1953–54 held degrees from 404 other colleges and universities, 253 American and 151 foreign. In September, 1953, a total of 293 students, being veterans of the Armed Services, registered under Public Law 16, 346, or 550. During the Spring Term this number increased to 297 and during the Summer Session was 102. We expect that our total enrollment during this coming year under these laws will increase somewhat.

The change in the character of the Summer Session at M.I.T. is reflected in the following statistics: During the 1954 Summer Session 35 different Special Summer Programs were carried out. This compares with 26 last year and 22 the year before. The duration of these programs ranged from one to six weeks, but 22 of them were each for a two-week period. The actual Special Summer Program attendance was 1,510, approximately equaling for the first time the number of summer registrants in the regular Institute subjects.

Concurrently with this series of Special Summer Programs and shorter conferences, a program of regular M.I.T. subjects was offered to graduate and undergraduate students. It is interesting to note that the number of subjects offered during this past summer was 115, compared to 179 in 1953 and 235 in 1952. The planned decrease in the number of subjects offered has had practically no effect upon the number of persons registered for this part of our summer session.

Enrollment at M. I. T.



Student Aid. Scholarship grants totaled $292,105 to 598 undergraduate students in 1953–54, compared with $265,990 to 636 students the year before. Some undergraduates held both scholarships and loans. A total of 392 undergraduates received loans as of June, 1953, amounting to $253,624. This compares with 283 students receiving loans as of June, 1952, amounting to $167,540.

Total graduate scholarships and fellowships for 1953–54 amounted to $391,940, and these scholarships and fellowships were granted to 250 recipients. This compares with $332,013 granted to 227 recipients in 1952–53. A total of 114 fellowships was sponsored by industrial companies, compared with 97 in 1952–53. Staff tuition was paid from departmental funds in the sum of $140,905 in behalf of 330 other graduate students holding part-time service appointments.

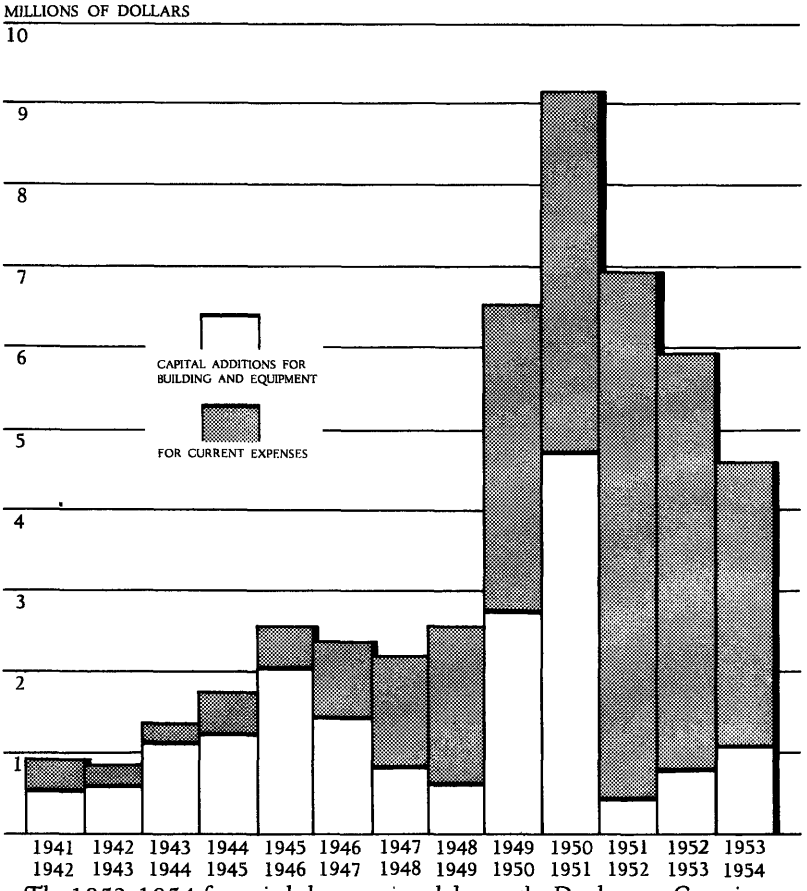
From both graduate and undergraduate students the Loan Fund Board received 596 applications during 1953–54 and acted favorably on 531, or 89.1 per cent, lending $326,312. In 1952–53, 390 students—91.3 per cent of those who had applied—received $217,268 from the Loan Fund. Last year's activities brought the cumulative total of Loan Fund operations to 4,045 men aided over a period of 24 years, with loans during that period of $3,083,877.

The Student Personnel Office placed 1,174 students in jobs during the academic year. These students earned about $225,000, which compares with $190,000 in 1952–53.

Finances. During 1953–54 our academic budget amounted to $13,693,000, as compared with $13,673,000 in the fiscal year 1952–53. Reimbursement for direct costs on research contracts of the Division of Industrial Cooperation (not included in the above) was $15,240,000 in 1953–54, compared with $14,911,000 in the previous year; and for the Division of Defense Laboratories, $17,248,000 in 1953–54 and $14,431,000 in 1952–53.

The Institute's endowment and other invested funds now have a total book value of $63,084,000 and are invested in securities and other assets with a market value of $85,648,000. Plant assets stand at $34,417,000, about $1,452,000 above last year. The rate of income earned in 1953–54 on the funds sharing in the general investments was 5.15 per cent of the book value of the funds, compared with 5.00 per cent last year. For the seventh successive year, 4 per cent was allocated to the funds. Unallocated investment income in the amount of $593,000 was added to the balance of undistributed investment income, bringing this reserve up to $2,390,000.

Total Gifts received each year since 1941

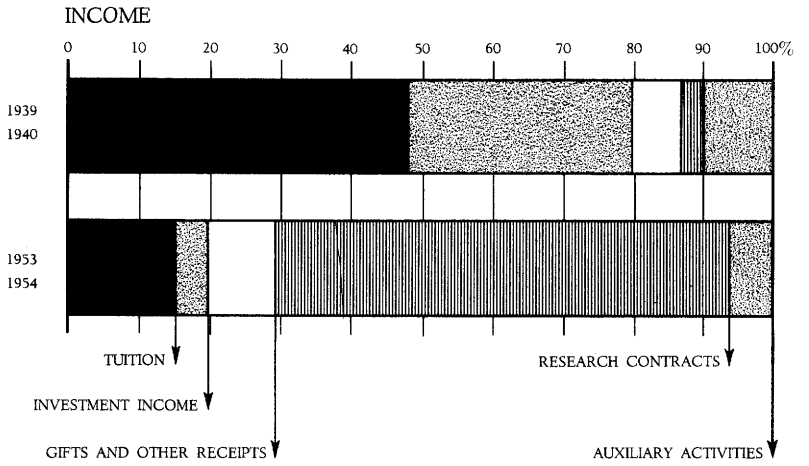


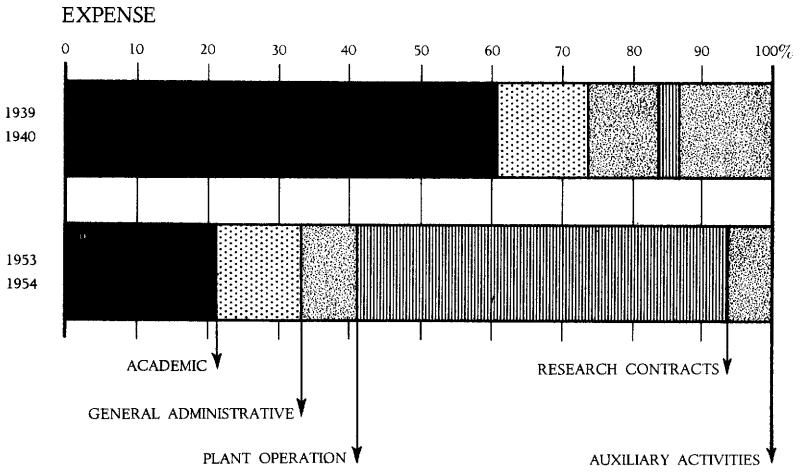
The 1953-1954 figure includes maturing pledges to the Development Campaign.

Distribution of the Major Elements of Income and Expense

In less than a decade research has grown to become a major partner and tool in teaching.

The 1953–1954 figures do not include operations of the Division of Defense Laboratories.





In Conclusion

These notes on the past and the future of our institution are colored at every point by the catastrophe of Karl Compton's death. So much of what the Institute means to those who study and work here and to the public, so much about it that is beloved and admired, reflects his influence and his leadership. In contemplating the loss we have suffered we can overcome the deep sense of tragedy only by realizing the permanence of his contributions. The Massachusetts Institute of Technology will always reflect his greatness and each of us who knew and worked with him will have a sense of gladness in having been associated with him. Could he do so, he would be the first to stress the motto inscribed on the marble fireplace in his office: "Alia initia e fine." Thanks to him there will be many new beginnings.

One word more. In all of Karl Compton's career at the Institute and in all that he did for it he was supported and assisted by Mrs. Compton. She too has helped to make this institution a nobler, happier and friendlier place, and the combination of Karl and Margaret was a partnership greater than the sum of its parts. We hope that Mrs. Compton will long maintain her close association with the Institute community, assured that she is beloved and cherished as a member of the Institute's family.

Respectfully submitted,

JAMES R. KILLIAN, JR., *President.*

Cambridge, Massachusetts, October 4, 1954

Changes in Corporation Membership

Year ending October 1, 1954

LIFE MEMBER APPOINTMENTS:

ROBERT T. HASLAM
RALPH LOWELL

TERM MEMBER APPOINTMENTS:

Special, for five years: THEODORE V. HOUSER
Alumni, for five years: HORATIO L. BOND
RAY P. DINSMORE
WILLIAM J. SHERRY

TERM EXPIRATIONS:

(*Elected Life Member*) RALPH LOWELL
(*Elected Life Member*) ROBERT T. HASLAM
RUDOLF F. HAFFENREFFER
GEORGE J. LENESS

TRANSFER TO EMERITUS STATUS:

WILLIS R. WHITNEY

Changes in the Faculty

Year ending October 1, 1954

PROMOTIONS

To Professor:

RICHARD H. BOLT, *Electrical Engineering*
GEORGE DESANTILLANA, *Humanities*
M. STANLEY LIVINGSTON, *Physics*
RICHARD C. LORD, *Chemistry*
COL. CHARLES M. MCAFEE, JR., *Military Science*
WILLIAM M. MURRAY, *Mechanical Engineering*
WALT W. ROSTOW, *Humanities*
DAVID F. WAUGH, *Biology*
KARL L. WILDES, *Electrical Engineering*
GLENN C. WILLIAMS, *Chemical Engineering*

To Associate Professor:

MARTIN A. ABKOWITZ, *Naval Architecture*
HOLT ASHLEY, *Aeronautical Engineering*
NORMAN C. DAHL, *Mechanical Engineering*
FRANCIS L. FRIEDMAN, *Physics*
THOMAS P. JONES, JR., *Electrical Engineering*
SAMUEL J. MASON, *Electrical Engineering*
MAJ. FRANKLIN B. MOON, *Military Science*
ROBERT M. SOLOW, *Economics*
KENNETH R. WADLEIGH, *Mechanical Engineering*
DAVID C. WHITE, *Electrical Engineering*
ROBERT W. WILLIAMS, *Physics*

To Assistant Professor:

THOMAS V. ATWATER, JR., *Industrial Management*
EDWARD H. BOWMAN, *Industrial Management*
RICHARD J. CHARLES, *Metallurgy*
GEORGE W. CLARK, *Physics*
THOMAS P. GOODMAN, *Mechanical Engineering*
ROY OLTON, *Economics*
JESSE N. PROCTOR, JR., *Economics*
VINCENT J. ROGGEVEEN, *Civil Engineering*
JACK W. ROSENGREN, *Physics*
ALBERT H. RUBENSTEIN, *Industrial Management*
STEPHEN M. SIMPSON, JR., *Geology*
ALAN H. STENNING, *Mechanical Engineering*
LAWRENCE W. TOWNER, *Humanities*
LEON TRILLING, *Aeronautical Engineering*

APPOINTMENTS

Professors:

BILLY E. GOETZ, *Industrial Management*
DOUGLAS M. MCGREGOR, *Industrial Management*

Visiting Professors:

EUGENE W. BURGESS, *Economics, fall term 1954*
EVERETT E. HAGEN, *Economics, for one year*
BENJAMIN HIGGINS, *Economics, for one year*
WILFRED MALENBAUM, *Economics, for one year*
FOLKE ODQVIST, *Mechanical Engineering, spring term 1954*
PAUL N. ROSENSTEIN-RODAN, *Economics, for one year*
ALEXANDER B. TODD, *Arthur D. Little Professor in Chemistry, fall term 1955*

Associate Professors:

LT. COL. JOSEPH S. BRINKLEY, JR., *Military Science*
COL. CHARLES M. MCAFEE, JR., *Military Science*
COMDR. JACK A. OBERMEYER, *Naval Architecture*
MAJ. VERNON E. ROBBINS, *Military Science*

Visiting Associate Professors:

MAC V. EDDS, *Biology, spring term 1954*
LEO R. SARIO, *Mathematics, spring term 1954*
ROBERT M. SAUNDERS, *Electrical Engineering, for one year*

Assistant Professors:

IRVING H. BARTLETT, *Humanities*
RICHARD C. BOOTON, JR., *Electrical Engineering*
WILLIAM F. BRACE, *Geology*
LEE C. BRADLEY, III, *Physics*
ALBERT BUSH-BROWN, *Architecture*
FREDERICK W. DEDERICK, *Air Science*
GEORGE ECONOMOS, *Metallurgy*
JOSEPH D. EVERINGHAM, *Humanities*
ANDREW B. JACK, *Industrial Management*
HERMAN W. LEWIS, *Biology*
CAPT. E. H. LITTLEJOHN, *Military Science*
GORDON MACDONALD, *Geology*
WILLIAM J. MCGILL, *Economics*
PAUL PASLAY, *Mechanical Engineering*
HENRY M. PAYNTER, *Mechanical Engineering*

ERNEST RABINOWICZ, *Mechanical Engineering*
ROBERT C. REID, *Chemical Engineering*
THOMAS P. RONA, *Mechanical Engineering*
KENNETH N. STEVENS, *Electrical Engineering*
VICTOR H. YNGVE, *Modern Languages*

Visiting Assistant Professors:

HERMAN E. KOENIG, *Electrical Engineering, for one year*
ROBERT F. LAMBERT, *Electrical Engineering, for academic year*
ROBERT J. LEVIT, *Mathematics, for academic year*
HEINRICH A. MEDICUS, *Physics, for one year*
ELIEZER MISHKIN, *Electrical Engineering, for one year*
DAVID WEI-CHI SHEN, *Electrical Engineering, for academic year*

RETIREMENTS

JOHN B. BABCOCK, *Professor in Civil Engineering; Lecturer in 1954–55*
GORDON B. WILKES, *Professor in Mechanical Engineering*

LEAVES OF ABSENCE

Leaves for varying lengths of time during the year have been granted to the following:

Professors

ALEX BAVELAS
ALFRED D. CHANDLER
IRVIN S. COHEN
CHARLES D. CORYELL
GEORGE DESANTILLANA
MARTIN DEUTSCH
HERMAN FESHBACH
DAVID H. FRISCH
CLARK GOODMAN
DAVID N. HUME
CHARLES P. KINLEBERGER
WILLIAM L. KRAUSHAAR
CHIA-CHIAO LIN
GEORGE A. MILLER
CHARLES A. MYERS
NORMAN J. PADELFORD
JOSEPH A. PECHMAN
WILLIAM H. RADFORD
FRANCIS W. SEARS
WALTER H. STOCKMAYER
C. GARDNER SWAIN
ROBERT V. WHITMAN

DEATHS

FREDERICK H. BAILEY, *Professor of Mathematics, Emeritus*
HAROLD K. BARROWS, *Professor of Hydraulic Engineering, Emeritus*
HARRY W. GARDNER, *Professor of Architectural Design, Emeritus*
ERNEST F. LANGLEY, *Professor of French, Emeritus*
RONALD H. ROBNETT, *Associate Dean of the School of Industrial Management*
GEORGE E. RUSSELL, *Professor of Hydraulics, Emeritus*

RESIGNATIONS

Professors

COLONEL CHARLES F. BAISH
COMMANDER JAMES A. BROWN
PROFESSOR J. C. BALSBAUGH
ARTHUR E. FITZGERALD

Associate Professors

LAWRENCE B. ARGUIMBAU
MAJOR JOHN P. COX
ERNEST P. NEUMANN
WILLIAM M. PEASE
LT. COLONEL WOODROW W. REAGAN
REINHARDT SCHUHMANN, JR.
COLONEL JOHN S. SHAPLAND

Assistant Professors

LOUIS H. AHRENS
HENRY C. BOURNE, JR.
RALPH A. BURTON
JOSEPH BYRNE
CAPTAIN JOHN F. CLEARO
CAPTAIN CLIFFORD D. COBLE
JAMES S. CROSS
SEIBERT Q. DUNTLEY
ROGERS B. FINCH
CYRIL C. HERRMANN
F. RALPH KOTTER
LEONARD MAUNDER
W. H. STERG O'DELL
RALPH RAPSON
ROGER M. STINCHFIELD
CAPTAIN WILLIAM J. SULLIVAN
JOHN R. SUMMERFIELD
CHIN-TSE YANG

Changes in the Administration

Year ending October 1, 1954

APPOINTMENTS:

EUGENE R. CHAMBERLAIN, *Assistant to the Director of Admissions*
ADM. EDWARD L. COCHRANE, *Vice-President for Industrial and Governmental Relations*
PAUL V. CUSICK, *Assistant Treasurer*
JACOB P. DEN HARTOG, *Head of the Department of Mechanical Engineering*
HAROLD E. DREYER, *Associate Personnel Officer*
WOLCOTT A. HOKANSON, *Bursar*
JOE JEFFERSON, *Assistant to the Director of Admissions*
ROBERT M. KIMBALL, *Secretary of the Institute*
BRUCE F. KINGSBURY, *Executive Secretary of the Educational Council*
HAROLD R. LAWRENCE, *Industrial Liaison Officer*
R. COLIN MACLAURIN, *Director of General Services*
COL. CHARLES M. MCAFEE, JR., *Head of the Department of Military Science*
JAMES H. MEANS, *Acting Medical Director*
JOHN O. OUTWATER, JR., *Industrial Liaison Officer*
CARL M. F. PETERSON, *Director of Physical Plant*
J. FRANCIS REINTJES, *Director of the Servomechanisms Laboratory*
DELBERT L. RHIND, *Assistant Treasurer*
JOHN W. SHEETZ, *Assistant to the Director of General Services*
C. RICHARD SODERBERG, *Dean of the School of Engineering*
PHILIP A. STODDARD, *Associate Placement Officer*
GEORGE E. VALLEY, JR., *Associate Director of Lincoln Laboratory*
RALPH L. WENTWORTH, *Industrial Liaison Officer*
DONALD WHISTON, *Executive Officer to the Director of Physical Plant*

RESIGNATIONS:

ARTHUR L. BRYANT, *Executive Secretary of the Educational Council*
THOMAS CANTWELL, *Industrial Liaison Officer*
DANA L. FARNSWORTH, *Medical Director*
MERTON C. FLEMINGS, *Industrial Liaison Officer*
WALTER H. GALE, *Secretary of the Institute*
(now Administrative Associate)
MARGARET P. HAZEN, *Reference Librarian*
EUGENE B. SKOLNIKOFF, *Industrial Liaison Officer*
RICHARD W. WILLARD, *Assistant to the Director of Student Aid*

Reports of the Deans of the Schools

School of Architecture and Planning

In the past year the staff of the School of Architecture and Planning has made a careful study of existing educational policies and given consideration to changes which would give greater strength and flexibility to our curriculum.

The demands our modern society makes on the architectural and the planning professions cover such a wide range of interests and activities and require so many aptitudes and skills that a school must continually search for new paths and for better methods of discharging its duties. The powers to visualize and to imagine have been attributes that people have rightly expected of a future architect; but a good architect must also be able to analyze

and correlate; he must develop skills to express and to convince, the passion and the courage to experiment and dissent — and yet to do so without trespassing on the boundaries of common sense. This requires knowledge in many technical fields and that discipline which is induced by a humanistic culture. It is difficult to predict in the early years of a student's life which combination of aptitudes will produce a good architect, at what rate and in which direction his mind will develop, or how he may react to various external stimuli.

A school therefore must be prepared to give the student strong guidance in his early years and a variety of choices in his later years. This it is possible to do at M.I.T., where so many fields related to architecture and planning are open to the student: history; social sciences; economics; mechanical engineering; product design; acoustics; structural engineering; lighting; solar energy; research in construction, in materials and in methods; and many others. Obviously no individual student can hope to enroll for all possible combinations of courses; but if much of his time is released for a choice of electives in his advanced college years he will be challenged to greater self-direction. A good school must provide a climate of stimulated interest where the best students may find themselves. For this purpose we wish to continue to invite prominent architects, planners, engineers, historians and philosophers to come to our School for short or long stays — thus providing the students with that healthy attitude of reflective doubt which comes from listening to the opposing philosophies of mature minds.

In the Department of Architecture, changes wrought in the five-year curriculum in the light of such beliefs have been presented to and approved by the Faculty. They will be placed in force during the coming year. In addition to technical simplification and renumbering of subjects the revision places both history of architecture and elementary visual design at an earlier stage of the course, changes the study of visual design from six hours a week by a hundred students at a time to twenty hours a week by a greatly reduced number at a time and opens the later years of the course to greater freedom in the choice of professional elective studies. Enrollment in the Department continues at a high level and students admitted to the Graduate School were selected from a very large and well-qualified group of applicants.

In the Department of City and Regional Planning modifications have been made in the individual subjects, such as the placing of greater emphasis on metropolitan regional problems by the courses in planning techniques and practice. The curriculum has also been strengthened by the introduction of new lecture subjects in industrial location and regional development by Professor Walter Isard.

Due to the low enrollment the four-year undergraduate course in this Department has been suspended. Students who wish to complete their undergraduate preparation at the Institute for advanced work in city and regional planning will be encouraged to register either in Course IV-A or Course IX-B, with appropriate electives in each case.

In the City and Regional Planning Department graduate enrollment for the past year was somewhat below the peak established during the post-war years, but prospects for next year are favorable. It may be noted that before World War II there were only four schools offering courses leading to a professional degree in the field of planning, with a total enrollment of between thirty and forty students. Today at least twenty-two institutions are offering graduate or undergraduate programs, and the total enrollment now stands at nearly three hundred. .

Research. The Albert Farwell Bemis Foundation was terminated at the end of the year in compliance with an Institute policy decision to use the Bemis Fund for teaching purposes and to put research activities on a self-supporting basis. The Institute and the School continue to place great value on the educational contribution of the research program in architecture and planning, and the development of sponsored projects that are suited to our objectives and resources will be whole-heartedly encouraged.

The last published reports of the Foundation, a broad survey of technical and economic aspects of small house air conditioning entitled *Design of Residences for Climatic Comfort* by Thomas Vietorisz, and the *International Bibliography of Prefabricated Houses* by Phyllis M. Kelly and Caroline Shillaber, are being distributed with the aid of the Industrial Liaison Office and the Rotch Library, respectively. The Rotch Library will also handle requests for prior Foundation publications and will serve in the future as a center of

information regarding the published reports of research activities in architecture.

Research in architecture continues to focus on the design implications of technical and industrial advances. During the year the F. W. Wakefield Laboratory of Lighting Design extended its basic studies in the effects of luminous environment; a new project was undertaken under the sponsorship of the Monsanto Chemical Company to explore the rational applications of modern plastics in the construction and equipment of housing. Supervision for these projects was supplied by Richard W. Hamilton; Derek Phillips and Arthur G. Aldersey-Williams conducted the Wakefield work, and William H. Wainwright and Peter L. Floyd that for the Monsanto Chemical Company.

A research scholarship given by the firm of Voorhees, Walker, Foley and Smith through the American Architectural Foundation for an M.I.T. graduate student will further our goal of promoting research. This is in addition to scholarships and gifts which were given by Ernest A. Grunsfeld, Jr., by Samuel Marx and by Skidmore, Owings and Merrill.

Research on the processes of development of the metropolitan city and region is the focus for the program of studies being conducted by staff members and by the graduate students of the School through the Urban and Regional Studies Section. Two major areas are being studied by teams supported by grant-in-aid funds, and research in other areas is in the exploratory stage.

In April a grant was made by the Rockefeller Foundation for a three-year study of the "perceptual form of the city." This study, to be conducted under the joint direction of Professor Gyorgy Kepes and Professor Kevin Lynch, will analyze the visual impact of the "cityscape." The study will develop principles and techniques to be used by architects and city planners in the design of a more satisfying urban environment.

Professor Walter Isard is conducting studies of the industrial base and the economic interrelationships of metropolitan regions. During the year a study sponsored by the United States Department of Commerce on location factors in the petrochemical industry was completed. A three-year study of inter-relationships between Puerto Rico and mainland metropolitan regions was continued with grant funds from the University of Puerto Rico. In

April the Federal Reserve Bank of Boston made a grant for a study of community revenues and costs resulting from new industrial development.

Several graduate students in architecture, city planning and economics are now participating in these research studies and two or three student assistantships will be established in connection with the study of city form.

Symposia, conferences and special courses have been organized by the School or jointly sponsored with other departments of the Institute. Conferences on Point-Four Housing, on Thin-Shell Construction, on Acoustics, on Visual Design and on Fire Protection Engineering have been very successful and have added prestige to the School and to the Institute. The Conference on City and Regional Planning which was held at the end of August brought the largest registration on record for this annual event.

Personnel. Professor Ralph Rapson resigned from the staff to accept the headship of the School of Architecture at the University of Minnesota. The Department of Architecture had the following visiting lecturers during the year: Steen Eiler Rasmussen, professor at The Royal Academy of Fine Arts, Copenhagen, and author of *Towns and Buildings* and *London, The Unique City*, served one term as a visiting critic for graduate students and presented a series of nine illustrated lectures on architecture which were of great interest to the School. Hugh Morrison, professor at Dartmouth College, and William H. Pierson, professor at Williams College, successively presented two terms of architectural history lectures pending the appointment of a full-time teacher of history. Roy Childs Jones, retired head of the School of Architecture at the University of Minnesota, assisted as critic for thesis work during part of the spring term. Hugh Stubbins, Jr., formerly of the School of Design of Harvard University, and a practicing architect, was visiting critic for fourth-year students for a two-month period.

Activities of the Staff. Professor Herbert L. Beckwith became President of the National Architectural Accrediting Board. The convention of the Association of Collegiate Schools of Architecture was held in Cambridge in June; Professor Lawrence B. Anderson is the President of the Association and Professor Burnham Kelly

was on the convention's Program Committee. Staff members contributed effort toward activities associated with the American Institute of Architects' convention held in Boston in June. Professor Kelly was chairman of the committee to produce a guidebook to Boston architecture which was distributed at the A.I.A. convention; the device and typography for the convention literature was designed by Professor Gyorgy Kepes. Professor John T. Howard was elected President of the American Institute of Planners, and Professor Louis B. Wetmore was elected President of its New England Chapter. Professor Frederick J. Adams served as a United Nations delegate to the Regional Seminar on Housing and Community Improvement held at New Delhi, India, during February, at which he presented a paper on "The Education of Planners."

Future Needs. There is still a pressing need for tuition scholarships, and it is to be hoped that ways may be found to have the profession and especially the alumni contribute to a fund for such a purpose.

Also becoming more apparent is the need for instruction in landscape architecture. Our students upon graduating seem to lack the feeling for the relationship of building to site. We hope to re-establish such courses, perhaps in co-operation with the Harvard School of Design.

The problem of space and of student desks is still acute, but we have hope that it may be fully solved in the near future.

PIETRO BELLUSCHI

School of Engineering

The School of Engineering is guided by precepts which have evolved over the years and which are the results of the initiative of many of its members. The years of my predecessors, Professor Thomas K. Sherwood and Admiral Edward L. Cochrane, have been unusual for vigorous activities in education, research and professional work. There is no sign of any diminishing of creative impulses, and it appears rather that the present year, under the Deanship of Admiral Cochrane, has been of particular significance.

One of the characteristic aspects of the present epoch is that the major engineering disciplines have a tendency to expand into wider segments of the field of technology. The older patterns are changing, and it becomes increasingly difficult to find simple guides for the delimitation of these disciplines.

In its original conception the Institute, particularly its forerunner to the present School of Engineering, was undoubtedly looked upon as a microcosm of the external world of technology. Each one of the major departments had a counterpart in that external world. The numerical course designations at M.I.T. stand as a reminder of the historical process by which the disciplines emerged into tangible entities.

In actual fact, the external world of technology never was divided in quite the precise pattern implied by the designations; a glance at the present programs of the various departments also suggests that the picture is no longer true for the Institute itself. There is a blurring of the professional pattern which has increased markedly during the recent years of intensive creative activity. As this process continues the various departments will continue to respond, more or less, to the whole external complex of technology. They will thus tend to differ more through methods of approach and emphasis than through different syntheses of sharply defined professional fields. Most of the major subdivisions of applied science will be taught in several departments. The departments will tend to become units of administration through which the initiative of their leading personalities will find expression.

This is one of the significant by-products of the increasingly close interrelation between the members of our staff and the world of engineering. Most important perhaps is the large sponsored research program in the School of Engineering, through which the full responsibility for major research and development undertakings has been accepted by members of the Faculty. The Industrial Liaison Program, which has placed many of our Faculty in close contact with industry, the increasing participation of staff members in professional work on the outside and the addition to the Faculty of men with a mature industrial background are other factors which have played an important role in this process.

It is my conviction that this tendency, even though it gives rise to baffling administrative problems, is a gratifying sign of strength and healthy development. Many of the major advances in technology of recent years have been due to intermixing of fields, so that the earlier and rigid synthesis is no longer a reflection of reality. What has been called a blurring of the professional pattern, therefore, is nothing more or less than a belated introduction into our educational system of the facts of life.

Nevertheless the picture has negative aspects which must receive attention in the long run. In the welter of technological activity there is a risk of lessened attention to the less striking — but equally important — development of fundamentals in applied science. The duplication of effort in certain fields — fluid mechanics might be mentioned as one of many examples — involves the risk of lack of focus on basic work. We may find it difficult to stimulate the emergence of commanding creative talent unless some way is found to focus properly our material and human resources. With awareness of such dangers, however, we can look forward to the future with confidence.

There are other signs that the forces from the world of reality are at work in engineering education. Several of the departments are beginning experiments in engineering education whereby the monotonous sequence of fundamentals followed by application may gradually be broken. Many of us have felt that this sequence overlooks the elementary facts of motivation. Many of the boys who come to M.I.T. do so because of an inborn flare and a liking for some field of technology. Their enthusiasm has all but vanished by the time they reach any of these applications. It is barely possible

that the gropings that are now going on in several minds of the School of Engineering may in time lead to a significant resolution of this difficulty.

With this problem in mind some of the departments have already begun to introduce their sophomores to some aspects of professional work. Such a program has been under way for some time in the Department of Chemical Engineering and is now a regular part of its curriculum. Both the Mechanical and Chemical Engineering Departments give senior subjects which aim to develop professional judgment and maturity. Civil engineering is studying the problem of inverting the customary procedure in professional education with the idea of strengthening motivation and developing imagination. In mechanical engineering a program of creative engineering has been under development for some time. The new curriculum of electrical engineering has a broader professional outlook as one of its objectives. The Aeronautical Engineering Department, forging ahead into new directions of development and literally attempting and succeeding at the impossible, has given the participating staff no less significant educational opportunities.

Facilities. The year has been one of consolidation of facilities; no new installation of major proportions has come into existence. Nevertheless, several important changes have been made. New facilities have been planned for the Instrumentation Laboratory of the Aeronautical Engineering Department in the Whittemore Building, returning the Hood Building to the Atomic Energy Commission. The rearrangement of space in the Electrical Engineering Department will be completed this year, and in mechanical engineering the alterations in the Engine Laboratory, under consideration for some time, have been initiated. The Charles Milton Spofford Room, which is administered by the Department of Civil and Sanitary Engineering, was put into operation in the fall of 1953. The Edward F. Miller Room, for which funds were donated by the alumni of Course 11, will be completed during the summer.

Staff. Professor James Holt was appointed Acting Head of the Mechanical Engineering Department following my appointment as Dean of Engineering on April 1, 1954. He served in that

capacity until September 1, 1954, when Professor J. P. Den Hartog was appointed Head of that Department.

Professor Murray P. Horwood returned in July, 1954, from his appointment at the University of Rangoon and has been named Professor of Sanitary Science and Director of Sanitation. He will be attached to the Medical Department but will continue part of his program of teaching in the Department of Civil and Sanitary Engineering.

Professor George C. Manning of the Department of Naval Architecture and Marine Engineering has returned from his leave of absence as Visiting Professor in the Department of Naval Architecture at King's College of the University of Durham in England.

Other staff changes are referred to under the respective departments.

Aeronautical Engineering. With Professor C. Stark Draper as its leader, the Department of Aeronautical Engineering has achieved a remarkably wide synthesis of its professional field, developing strength in many diversified directions. The undergraduate enrollment continues to be low in relation to the total operations, and there are no clear signs that this situation will change in the near future. The employment opportunities in aeronautical engineering continue to be excellent, the demand being far ahead of the supply. The opportunities for men with advanced training are particularly good, and this fact undoubtedly accounts for the continued high graduate enrollment — of which officers of the armed forces comprise about half.

The Class of 1954 is the first to complete the program planned in the curriculum revision of 1951. The plans formulated then will continue in force with only evolutionary changes. The Department's co-operative course shows an improved position despite the decline in undergraduate enrollment. Ten of the leading aircraft companies and three laboratories of the National Advisory Committee for Aeronautics participate in this program.

The characteristic feature of this Department is its extensive program of sponsored research, the largest in the School of Engineering. During the past year this has involved an expenditure of approximately seven million dollars, representing the work

of 850 full-time men, 95 per cent of whom were on the D.I.C. staff. The major part of the work is sponsored by military establishments, and a large part of it is under military classification although increasing segments of the work have recently been released. Research contracts with industrial firms are beginning to appear and are encouraged as a healthy shift in activities.

The sponsored research program covers all branches of aeronautical engineering and is in part responsible for the wide coverage of the Department's operations. The projects have all been initiated because of the urgent needs of the military forces and the special talents available in the Department. The interrelationship between sponsored research and the educational program varies with the projects and is necessarily the least pronounced where classification is the most rigid. Serious efforts are being made to strengthen this interrelation all along the line.

The major research groups of the Department are the Laboratories of Aeroelasticity and Structures, Instrumentation, Flight Control, and Transonic Aircraft Control. In addition there are the Wright Brothers Wind Tunnel — now modified for blowdown operation as well — and the Naval Supersonic Laboratory. The Gas Turbine Laboratory is operated in co-operation with the Department of Mechanical Engineering. Members of the academic staff are associated with one or more of these laboratories; unfortunately only a few aspects of their operations can be covered in this report.

The Aeroelasticity and Structures Laboratory, under Professor Raymond L. Bisplinghoff, is achieving a position of leadership in its important field. This is one of the fields where it has been possible to concentrate on basic problems. Strong efforts are being made to improve the facilities available for this work. An electric furnace for testing aircraft structures at high temperatures is under development, and facilities for fatigue tests are gradually becoming available. This work derives strength from close association with the groups on aerodynamics and instrumentation.

Notable achievements have been made by the fluid dynamics group (Professors Holt Ashley, Morton Finston, Robert L. Halfman, and Leon Trilling) in observations of the transient and steady state transonic and hypersonic aerodynamics through

the use of advanced measuring techniques. Several of these were reported in doctor's theses presented during the year.

Chemical Engineering. Under the leadership of Professor Walter G. Whitman and his associates, the Department of Chemical Engineering is continuing its program of innovations in undergraduate education. Professor Thomas K. Sherwood has introduced a new professional senior elective aimed at cultivating integrated judgment and decision. About a dozen of the Department's Faculty are now participating in the introductory course in chemical engineering for sophomores. The object here is to introduce the young students to the nature of chemical engineering work by participation in a simple professional problem involving qualitative considerations blended with applied science. Both of these ventures have elicited much enthusiasm from staff as well as from students.

The dip in undergraduate enrollment, which lasted about four years, is now over, and the graduating class of 1956 will be nearly as large as the peaks which followed the war. Graduate enrollment has also increased somewhat. The demand for graduates at all levels continues greatly to exceed the supply.

Graduate instruction in nuclear engineering under Professor Manson Benedict is exhibiting a healthy growth. Interest in this field is enhanced by the Atomic Energy Commission's program to implement the President's policy for developing peaceful uses of the atom. M.I.T. has embarked on plans to design and build a small reactor, which is vitally needed for nuclear engineering instruction and which should have manifold research uses in many departments of the Institute. A summer study for the Atomic Energy Commission, headed by Professor J. Edward Vivian, promises valuable contributions to the problem of separating products from reactors, a problem of utmost significance in our progress toward economical civilian power.

The completion this year of two major enterprises to revise textbooks is most gratifying. *Industrial Stoichiometry,* which was first issued in 1926 by Lewis and Radasch, has been completely rewritten with the collaboration of Dr. Warren K. Lewis' son as a co-author. Professor William H. McAdams' authoritative text on *Heat Transmission* has been extensively revised to incorporate latest

information and techniques and the more comprehensive understandings which have recently developed.

Civil and Sanitary Engineering. With Professor John B. Wilbur as leader, the Civil and Sanitary Engineering Department has initiated a study of new concepts in undergraduate education in civil engineering. The method is to stimulate interest in the field by early introduction to elements of the art, with the analytical approach following at a later stage. The objectives are not only better motivation for the study of applied science but also the encouragement of traits of boldness and imagination which are indispensable to creative engineering.

With the merging of the activities in building engineering and construction with the Department of Civil and Sanitary Engineeringit has become necessary to give attention to the professional structure of the Department and its program. While these three major fields may retain their identities at the graduate level, it appears desirable to consolidate further the undergraduate program. The Visiting Committee has recommended two undergraduate options: (1) Planning and Design; and (2) Construction and Management.

The Department continues to operate at substantially the same level as last year with respect to both student enrollment and sponsored research. The six divisions of the Department (Structural, Soil Mechanics, Hydraulics, Building Engineering and Construction, Transportation and Surveying and Sanitary Engineering) are all active in their respective fields, with a fine balance of teaching, sponsored research and professional activity.

During the summer of 1953 the Surveying Camp at East Machias, Maine, was used for the last time for instruction in surveying, terminating a tradition which had been in existence since 1912. In 1954 a summer program was held in Cambridge as part of the process of transition. In the future surveying will be taught in Cambridge during the regular academic year.

Professor John B. Babcock, 3rd, who retired this year after thirty-eight years of faithful service to the Institute, will remain in the Department as a lecturer.

Electrical Engineering. Under the leadership of Professor Gordon S. Brown, the Department has completed the revision of

its undergraduate curriculum, which has been approved by the Faculty. The revision has entailed the development of eight new core subjects, each with associated laboratory, ranging through the upper three years. These aim to stress the underlying scientific content of present-day electrical engineering. Circuit theory, electronics, fields, materials and energy conversion have been particularly emphasized in the new core program. The system of options has been discontinued, but more elective time has been provided to permit students to pursue their individual special interests during the junior and senior years. By appropriate choice a student may prepare for a position in industry at the end of his undergraduate program or for continuation in a program of graduate study and research. The first class to complete this program will be that of June, 1955.

Construction has been started on the two lower floors of Building 10 to provide more effective work-space for the Energy Conversion Laboratory and its affiliated contract research project. This work is part of the continuing program for the revitailzation of the electric power field of the Department. The service machine shop will be combined with the student shop, and both will operate as a unit in an enlarged area now partly occupied by the student shop. The new basement entrance and the removal of partitions on both floors will provide easier access to the laboratories, and the space allotted to the Feedback Control Laboratory will be increased.

Two significant changes were made in the electrical engineering co-operative course program during the past year: the Raytheon Manufacturing Company of Waltham, Massachusetts, joined the program on June 1; and a joint program was introduced whereby the American Gas and Electric Service Corporation and the General Electric Company will each provide half of the co-operative work for a group of about eight students from each class. This will give these men both manufacturing and operating company experiences.

The Edwin Sibley Webster Professorship was inaugurated this year with the appointment of Professor Arnold Tustin, Head of the Department of Electrical Engineering at the University of Birmingham, England. Professor Tustin proved to be a distinguished appointee and contributed much to the Department

through his teaching, his work on committees and the numerous individual lectures which he gave while here.

The Department was also greatly strengthened by the services of Mr. James G. Yates of Cambridge University, England, who, as a visiting Faculty member, participated extensively in the teaching program and made notable electronic-component contributions to the project on atomic clocks being carried out under the supervision of Dr. Jerrold R. Zacharias in the Research Laboratory of Electronics.

Mr. Charles A. Powel completed his fifth and final year as a Lecturer with the Department and retired on June 30 at the age of 70. Mr. Powel is a retired Westinghouse engineer who drew on a vast source of personal professional experience in making his contribution to the Institute. He will be greatly missed.

Richard H. Bolt, Director of the Acoustics Laboratory, was appointed Professor of Acoustics of the Department of Electrical Engineering.

Professor William K. Linvill is inaugurating a teaching-research program in data processing beginning this fall, to be housed on the third floor of Building 10. This program will be run in co-operation with the Digital Computer Laboratory and will provide educational opportunities for research assistants and other graduate students.

Graduate student and Faculty research in the sponsored laboratories within the Department continued at a high level.

The Laboratory for Insulation Research under Dr. A. R. Von Hippel made a notable contribution to the development of the new course in the Department called "Fields, Materials and Components." This recognition of the importance of an understanding by electrical engineers of the fundamentals of the properties of materials is a significant advance in engineering education.

During the past year industry has shown keen interest in the numerical control program of the Servomechanisms Laboratory. Several numerically controlled machine tools are now under development by outside companies. Because of the heavy demands on the Laboratory staff for technical assistance in the area of numerical control, a two-week Special Summer Program in Numerical Control of Machine Tools was sponsored this year.

Approximately forty industrial organizations sent representatives to this program.

The fire control computer under development in the Servomechanisms Laboratory for Division 4 of Lincoln Laboratory has been completed. A repackaged version of this computer is now being fabricated by an outside industrial organization. The United States Air Force and manufacturers of military aircraft are showing continued interest in the fire-control system evaluation program under way in the Servomechanisms Laboratory. It is expected that development work leading to a workable system will be completed during the coming year.

Mechanical Engineering. Professor James Holt has served as Acting Head of the Department during the period between my appointment as Dean of Engineering and the appointment of Professor J. P. Den Hartog as Head of the Department, effective September 1. Professor Holt's outstanding contributions to the operations of the Department, not only during the period of transition but also through his continued service as Executive Officer, are gratefully acknowledged.

While no major change has occurred during the year in the level of graduate and undergraduate enrollment, the heavier freshman enrollment during the last two years has resulted in an appreciably larger undergraduate student body with a consequent increase in the teaching load. The magnitude of the graduate activity is indicated by the fact that the Department awarded thirteen Doctor of Science degrees during the year. The sponsored research program has increased somewhat during the year and now involves an annual expenditure of $400,000, not including the Dynamic Analysis and Control Laboratory under Professor John A. Hrones. The major part of the program is conducted by the academic staff.

The co-operative course of the Department shows increased activity. Twenty-two students are now enrolled in this program, and twelve companies are participating.

Professor Folke K. G. Odqvist of the Royal Institute of Technology in Stockholm participated in the instruction program on a full-time basis during the spring term. The Department received very valuable comments and criticisms from this accomplished

scientist and teacher. Professor Kenneth R. Wadleigh returned from a year at Cambridge University in England, and Professor Gerhard Reethof is returning this fall from a Fulbright Lectureship at the Finland Institute of Technology in Helsinki. Professor Rogers B. Finch returned after a leave of absence while serving with the State Department on a Technical Assistance Mission to Burma but left after his return to accept a position at Rensselaer. Professor Gordon B. Wilkes retired after forty-three years of constructive service in charge of the Heat Measurements Laboratory. Professor Ernest P. Neumann resigned from the Department after a leave of absence of one year to continue work with the Ultrasonic Corporation.

The Department continues to be the center of much varied activity. During the summer of 1954 it offered ten of the thirty-five Special Summer Programs held at the Institute, serving primarily professional people from industry. Only a few aspects of the work in the eight divisions of the Department (Applied Mechanics, Machine Design, Machine Tools and Metal Cutting, Materials, Textile Technology, Thermodynamics, Sloan Automotive Laboratory and Gas Turbine Laboratory) can be covered in this report. On the instruction side, the modification of subjects to fit the new curriculum is now practically accomplished, although evolutionary changes will continue.

Professor Ascher H. Shapiro's work on the aerothermopressor, a device for raising the stagnation temperature of a gas, has continued with emphasis on atomization and droplet technology. Considerable progress has been made in a program of research on boiling heat transfer under Professor Warren M. Rohsenow. In the Gas Turbine Laboratory the studies of secondary flow, under Professor Robert C. Dean, Jr., have continued with valuable results. Professor J. Lowen Shearer has developed a high-pressure, compressed-air position servo-system with very high performance characteristics. In the Materials Division, under Professor Egon Orowan, a method has been developed for the direct measurement of stresses on the surface of transparent bodies such as glass.

The Dynamic Analysis and Control Laboratory, under Professor Hrones, has succeeded in diversifying its financial support and the character of its work. Its principal problem deals with

research and development in areas of importance to high-performance close-loop control systems. The Machine Tool and Metal Cutting Laboratory, under Professor Milton C. Shaw, has appreciably enlarged its sponsored research program, supported wholly by industry and conducted entirely by academic personnel.

The Department made progress during the year in providing physical facilities for some of the new aspects of its instruction program. The revision of the Engine Laboratory was initiated to implement the plans made by Professor William A. Wilson for strengthening the laboratory work through research and professional projects. With the completion of the Edward F. Miller Room in the basement under Department Headquarters, this region has much-needed facilities for promoting closer student-Faculty relations. The inventory and classification of all categories of visual aids is another step of great value to the instruction program.

Metallurgy. Under the leadership of Professor John Chipman, the Department of Metallurgy continues to hold its position of distinction in the field of metallurgy. Its research program has continued at about the same level; this program is closely interwoven with graduate instruction, and it covers a wide range of topics in metallurgy, mineral engineering and ceramics.

The acute need for metallurgists in American industry and the small number of graduates being turned out by metallurgy departments throughout the country has stimulated effort to increase enrollment in the Department. As part of this program, an exhibit was set up in the lobby of Building 7 which attracted very favorable attention. The exhibit included such items as a model of the Brookhaven nuclear reactor and a cut-away section of a J-47 engine accompanied by photomicrographs of metallic parts and with all metal and alloy compositions identified. A number of other highly interesting exhibits were also included. All of these were supplied through the courtesy of various manufacturers and co-operating agencies.

The research program in ceramics has developed strongly in recent years. During the year this was highlighted by the publication of a noteworthy series of papers in the *Journal of the American Ceramic Society* on the thermal conductivity of ceramic materials. This series of ten papers, prepared by Professor William D.

Kingery and six graduate students, is a milestone in the application of scientific measurement to the understanding and development of refractories for extreme temperature service. Of equal importance was another series on metal-ceramic interactions, a group of five papers prepared by Professor Kingery and two graduate students. This work is basic to future progress in the development of cermets, the metal-ceramic bodies which appear to offer great promise for structural purposes at very high temperatures. These researches are a logical outgrowth of earlier work on the part of Professor Frederick H. Norton and his students, which is also continuing actively, on clay bodies and on high purity oxide, carbide and nitride refractories. A new program on the structure and strength of glass has led to the development of electron-microscope replicas which give orders of resolutions far greater than have been obtained before.

During the year arrangements were completed for the establishment of Nuclear Metals, Incorporated, a commercial enterprise which will take over the development work on uranium and various alloys important in the development of nuclear power. This is the program which formerly had been administered as a part of the Department's research activity by Professor Albert R. Kauffmann. An important residuum of this research program will continue to be sponsored by the Atomic Energy Commission at M.I.T. under Professor Kauffmann's part-time supervision.

Meteorology. Under the leadership of Professor Henry G. Houghton, the Department of Meteorology continues a program of research and instruction in which graduate students are principal participants. While the undergraduate enrollment is very small many of the graduate students follow programs in meteorology consisting primarily of undergraduate subjects, since few of them have had undergraduate training in that field.

Reflecting the rapid advances in knowledge resulting from research at M.I.T. and elsewhere, the subjects of instruction have been continually revised. A new graduate subject on numerical weather prediction has proved very successful. The graduate subject in applied climatology has been developed by Professor Thomas F. Malone into the first integrated study of the applications of meteorological knowledge to problems of business and industry.

As a part of this course students make independent studies of specific problems on the basis of data furnished by individual companies. The undergraduate subjects in theoretical meteorology have been revised and consolidated. This change has made it possible to drop one subject and to strengthen this important aspect of the program.

The Department offered a Special Summer Program during the two weeks beginning June 21 which was designed to acquaint the practicing meteorologist with the most recent research results and to show him how they may be applied to his daily work. This program met with an enthusiastic response, with more than sixty meteorologists in attendance.

The backbone of the Department is the extensive research program, consisting of seven major projects sponsored by government agencies. A project under Professor Hurd C. Willett has developed evidence that solar outbursts affect the large-scale atmospheric circulations. More complete data are now being assembled from which it is hoped will come a better understanding of the nature of this important effect. The research group under Professor Victor P. Starr has demonstrated that the major latitudinal transport of angular momentum and of energy is accomplished by quasi-horizontal eddies rather than by means of meridional cells as previously believed. The consequence of this major discovery will be of fundamental importance in the further development of our knowledge of atmospheric circulations. The solution to these problems is being aided by a study of the motions resulting when a rotating pan of water is heated at the rim and cooled near the center. The remarkable resemblance between the motions in this model "atmosphere" and those of the real atmosphere suggest that the model contains the principal dynamic features of the real atmosphere.

A group under the direction of Professor Delbar P. Keily developed a cloud spectrograph which determines the drop size distribution of natural clouds by a unique optical method. The instrument was successfully tested on the summit of Mt. Washington.

A project under the supervision of Professor James M. Austin has made notable strides in our understanding of the genesis and growth of migratory cyclonic storms. This work has direct application to the problem of numerical weather prediction and,

in the light of Professor Starr's discovery, to studying the maintenance of the general atmospheric circulation.

Professor Thomas F. Malone heads a group engaged in the development of a new approach to the old field of climatology. A classification of the weather based on the circulation pattern has been found to yield consistent results in predicting temperature, rainfall and other weather elements. This is much more meaningful than a climatic classification based on temperature and precipitation alone, which is conspicuously deficient in characterizing the "weather" — a synthesis, in fact, of many other elements. This work has been possible only because of the availability of Whirlwind I. This new type of climatology makes possible the quantitative application of climatological information to a wide variety of problems in business, industry and other fields of science and engineering.

The Weather Radar Project under the direction of Mr. Alan C. Bemis has developed a unique instrumentation facility, based on radar, with which it is possible to make quantitative analyses of the characteristics of weather echoes. This facility is now being used to study the detailed processes by which precipitation is formed in the atmosphere. As so often happens, it has been found that the precipitation mechanism is much more complex than was previously thought. It is believed that the major problems can be solved with our radar installation through experiments guided by theoretical reasoning.

A research group at Round Hill under the general direction of Professor Henry G. Houghton has developed instrumentation and analytical techniques designed to reveal the nature of the turbulent fluctuations in the atmospheric boundary layers. These concepts are now being applied to a study of the diffusion of gaseous and particulate matter in this portion of the atmosphere.

As the science of the most important part of our physical environment, meteorology should have broad and beneficial application to a wide range of human activities that depend in one way or another on weather and climate. The present situation is almost the antithesis of this, with applications of meteorology confined to weather forecasting and to military problems. The Department hopes to find ways to broaden the applications of meteorology through research and educational programs designed to provide

increasing contact between meteorology and the other environmental sciences on the one hand, and a wide range of human affairs that affect the nation's economy and welfare on the other.

Naval Architecture and Marine Engineering. Under the leadership of Professor Laurens Troost, the Department of Naval Architecture and Marine Engineering continues its role of serving an industry that has made progress in spite of difficult business conditions. During the last six years the maximum deadweight of oil tankers has doubled in capacity per ship; and the *United States*, the most advanced ocean liner in existence, was completed only two years ago. The employment opportunities for the graduates of the Department are good and give every indication of so continuing.

With the establishment of Course XIII-B, Shipping and Shipbuilding Management, which will be offered beginning with the first term of the academic year 1954–55, Course XIII-C, Marine Transportation, has been discontinued.

The two sophomore professional subjects in Course XIII have been revised to encourage more originality and interest, a desirable trend which has been noted in other engineering departments mentioned in this report. The entire professional curriculum is under review with the benefit of Professor Troost's and Professor Manning's experiences in Europe. Graduate student enrollment in Course XIII-A, comprising U. S. Navy and U. S. Coast Guard Officers, continues relatively high, with the possibility of increasing. An Atomic and Nuclear Physics Option in Course XIII-A has been added, and some officers are taking it at present. The Hull Structure Laboratory is ready for use, and considerable activity in this field is under way by students, assistants and staff. During the past year both the towing tank and propeller tunnel have engaged in thesis and outside company-sponsored research, in one instance for a foreign flag shipping company.

Graphics. Under Professor John T. Rule, the Section of Graphics has faced the problem of readjustment due to the change in the first-year program. Roughly two-thirds of the freshmen continued to take Engineering Drawing and Descriptive Geometry. The sections were smaller and their members more interested in the subject matter, since all had elected the course. In Engineering

Drawing this permitted the introduction of individual projects of about three weeks' duration at the end of the term which proved to be highly successful, stimulating excellent student work. The Section hopes to experiment further in this direction.

During the year a course in Graphics Laboratory was given for the first time. This was almost a pure project course especially for students in the Department of Architecture. It was aimed at developing their powers of observation and their sense of form and design. The results encourage us to believe that a great deal can be done along these lines in the freshman year.

New freshman electives in graphics and nomography will be offered next year. All of the courses of the Section are being reviewed in an effort to stimulate more enthusiasm on the part of the students and to appeal to their creative ability.

C. RICHARD SODERBERG

School of Humanities and Social Studies

The School of Humanities and Social Studies contains the Department of Economics and Social Science (economics, industrial relations, psychology, political science), the Department of Humanities (history, literature, English, philosophy, music, fine arts), the Department of Modern Languages (French, German, Russian, linguistics) and the Center for International Studies whose primary focus is research. Each of the departments has research programs; each of the departments has teaching problems. The Department of Economics and Social Science has graduate students. This report seeks to relate the work of the departments as a whole, a composite School activity, and therefore does not deal with the departments severally but rather is organized by activities.

Every semester of every academic year, each undergraduate at M. I. T. normally studies at least one subject with some member of the Faculty of this School as part of the required humanities program. Moreover, the Department of Economics and Social Science offers additional undergraduate subjects for students in Courses XIV and XV; the Department of Humanities does a substantial amount of instruction in report writing for professional departments which request it, principally in Courses II and VI; and the Department of Modern Languages meets something like 800 students (undergraduate and graduate) who are satisfying one or another of the language requirements. This undergraduate task represents a very large portion of the total teaching done by our Faculty, and it is — and presumably will remain — a principal concern of this Faculty.

But we cannot provide first-class undergraduate teaching unless our Faculty members engage vigorously in scholarship, publication and other forms of advanced intellectual effort. The amount of research and publication carried on in this School has mounted spectacularly over the last decade, as the record published elsewhere in this volume will attest. The number of significant research projects involving the collaborative work of many members of the Faculty has grown steadily. Graduate study offered by the members of the Economics and Social Science Department to their own students and to those in the School of Industrial Management has also increased. All together, we have a solid graduate student and research effort underlying the undergraduate teaching.

A proper balance among duties to the undergraduate and duties to the graduate student and to scholarship has never been easy to achieve in any university, and the undergraduate is often short-changed. We have not worked it out perfectly in this School, but it seems fair to say that on the whole we do well at it and that we watch for improvement all the time; we are favored by the fact that the Faculty for undergraduate and graduate alike is, in accordance with general M. I. T. practice, a single Faculty.

Undergraduate Education. There have been few changes in our program of undergraduate education this year and none of policy. Experience with the freshman-sophomore curriculum has strengthened our opinion that the general approach is sound. It concen-

trates upon subject matter which is primarily humanistic in character and upon four high points of civilization each year rather than attempting a conventional historical approach or a survey of world civilization. When we thus limit our attention to compact geographical areas and limited spans of time, we can avoid textbooks and employ, instead, for each period a significant number of first-class source materials to be explored at length. To refer to these first two years as humanistic in character does not mean that the findings of social scientists are ignored or that social problems are overlooked, but rather that instead of being used as an end in themselves they become a portion of the historians' equipment which is essential to deal well with any period of time. We shall not change any of the periods for study in the next year.

Aided by The Rockefeller Foundation, we began an experiment which permitted qualified American freshmen to take the two-year core curriculum in French. In this first year we kept the section small; eleven freshmen were selected. They found the first weeks hard but then settled down. Only one student asked to be transferred to an English-speaking section at the end of the semester, but four more asked to be admitted and three were. Next year we will increase the size of the freshman section and carry on into the sophomore year with the former freshmen. We are pleased with the results, confident that this is an experiment which might prove fruitful elsewhere although we are well aware that we were fortunate in finding Professor Charles W. Rosen to conduct the experiment.

At the freshman level the Department of Modern Languages added two new electives, one in Spoken German and one in Spoken French. These are among the many electives now offered to freshmen under the new program of freshman study. Registration in these subjects was small, about a dozen in each in each semester. The Department of Humanities also provided freshman electives, one in English Composition and one in Public Speaking. About fifty students altogether elected the Composition, about a hundred the Speaking.

Upperclassmen in our required humanities-social science program normally elect a sequence of subjects in a field of their choice. We have not made large changes in these fields this year. We have dropped a number of trial history subjects which repre-

sented a duplication of contents or in which there was little student interest; the first subject in the literature sequence has been strongly revised to place less emphasis on the history of literature and more on the aesthetic qualities and values of the works studied. The first subject in the psychology sequence has been revised and improved. Two new subjects have been introduced in political science under the direction of Professor Ithiel de Sola Pool, a member of the staff of the Center for International Studies. The terminal subject in the economics sequence has now been made a seminar in Economic Problems.

The Economics and Social Science Department, in addition to its nationally famous graduate program, is responsible for undergraduate students who major in Course XIV, Economics and Engineering. This course of instruction is sharply different from that offered in the School of Industrial Management and is not competitive with it. The registration is not large, but the enrollment did increase moderately this year; the course seems pivotal to the entire development of the social sciences at the Institute. It deserves and needs more students.

Economics at M. I. T. has been strengthened greatly by the addition of economists and other social scientists to the Faculty of the School of Industrial Management. These men are beginning to lighten the burden of instruction which had increased by the growth of the Graduate School and particularly by the expansion of the Sloan Fellowship Program of the School of Industrial Management, much of the early burden of which fell upon the Department of Economics and Social Science; the Department still carries a very much larger load than it did before the School of Industrial Management was founded. The influx of economists into other parts of the Institute will make necessary an exercise of care to avoid unnecessary overlapping and duplication.

One of the problems in the Economics and Social Science Department is to find a means of utilizing the services of the distinguished staff of the Center for International Studies. Though the informal contacts of the regular staff and some of the graduate students with these Visiting Professors have been interesting and stimulating, we are not taking full advantage of their presence at the Institute. The use of Professor Pool in the political science program is a step in the right direction. We are now exploring the possi-

bility of setting up Economic Development as a field of concentration in our graduate program. But we have not fully solved the problem of the part-time use of this first-class talent in the ordinary programs of M. I. T., and we must solve it — although the focus of the Center's interest will of course remain research. However, existing commitments to present members of the Economics Department make any formal integration of the Center contingent upon the raising of funds for additional appointments to the Economics Faculty.

The Industrial Relations Section met about one-fifth of all M. I. T. undergraduates in some subject this year. Some of these were taking the upperclass elective sequence available to all undergraduates, some were taking professional courses as part of their Course XIV program, and a considerable number more were taking professional courses as part of their Course XV program. The Industrial Relations Section, moreover, had serious graduate responsibilities not only for its own doctoral candidates in Industrial Economics but for the Executive Development Program, for the two-year program leading to a Master's degree in Industrial Management, and for Naval officers taking graduate work in Course XIII. Staff members of the Industrial Relations Section offered seven different seminars for students in the School of Industrial Management and supervised nearly one-third of all theses written by Sloan Fellows as well as nine further Masters' theses by graduate students in Industrial Management.

Psychology has had a chequered history at M. I. T. We have earnestly sought to find an appropriate policy. We need and will continue to need men with skills in psychology of a number of different kinds, some in the Industrial Relations Section, some in other parts of the Economics Department or in the Schools of Industrial Management or Architecture. Also, a number of psychologists of quite different interests are concerned with problems arising in the Schools of Science and of Engineering. Whether all these talents can usefully or even practically be combined in one department certainly remains a moot question. To help us in reaching a more positive policy we invited a committee of psychologists to examine us and to make recommendations. The survey and report were made by Professors Donald G. Marquis of the University of Michigan, Lyle H. Lanier of the University of Illinois,

and S. Smith Stevens of Harvard University. They have recommended that we put psychology on a firm footing at M. I. T., emphasizing the work in experimental psychology which has flourished here under Professor Joseph C. R. Licklider and which has drawn to its research ranks a distinguished group of young but mature psychologists many of whom also participate in our undergraduate teaching program. Whether this group should finally be domiciled in the School of Science or the School of Humanities is not now clear, although there are many good reasons why the School of Science would be logical. The administration has approved this report as a working document, subject to the proviso that we will not establish this new effort on a permanent footing unless we can find new financing to support essentially four full-time permanent appointments. Efforts to find this financing are under way.

The other area of our general undergraduate instruction which has had its ups and downs has been that of the fine arts. This was in part the result of a conscious decision reached some years ago when it was evident that our upperclass electives in music and art were suffering because we could not put enough support back of both of them. At that time the work in music was on the more solid footing, and we concluded deliberately to drop the art subjects until we had consolidated the music effort. We continued to expose students to examples of art through the exhibits designed to accompany the core curriculum and through the general exhibition program and a few lectures in the core. Now the time has come when the music program has grown to stature and strength, and we must turn to the unfinished business involving art.

To guide us in this planning we again called in an outside inspection and recommending committee. This one was headed by Bartlett H. Hayes, Jr., of the Addison Gallery, and includes James Johnson Sweeney, Director of the Solomon R. Guggenheim Museum; Robert Iglehart, Chairman of the Department of Art Education of New York University; Charles H. Sawyer, Director of the Division of the Arts at Yale University; and John P. Coolidge, Director of the Fogg Art Museum at Harvard. Their report will be printed in full and should be an interesting document for anyone concerned with art education at the college level.

Besides dealing with problems of how we expose all students to some art stimuli, the report deals *in extenso* with a proposal that

we include laboratory instruction in visual design as one of the upperclass elective sequences. This does not mean, of course, conventional courses in painting or sculpture, nor is its purpose to produce amateur artists. It is something much more profound which may most quickly — if a little loosely — be described by saying that it is related to the experiences in the Bauhaus, the work of Moholy-Nagy in Chicago and more recently that of Professors Gyorgy Kepes and Richard Filipowski in our own School of Architecture. We approach this challenge with enthusiasm. We are fortunate that there is a good existent laboratory and faculty on which to build, and we welcome the opportunity for a closer co-operation with the School of Architecture. As in the case of the psychology work, new financing of a substantial kind is necessary; but we are optimistic that we shall find it, for we believe that if these courses are well carried out, in the spirit of the committee's recommendations, we may be establishing another "first" in engineering education.

. The exhibit programs in the Hayden Gallery continue to grow in strength and depth under the guidance of Professors Herbert L. Beckwith and William C. Greene. The work in music continues to draw many students, some 210 upperclassmen taking their elective work in this field. The performances of the Choral Society and the Orchestra, directed by Professor Klaus Liepmann, gain in stature every year. This year's leading performance of Honegger's "King David" received general professional critical acclaim. The Student Lecture Series Committee continues to operate essentially under its own steam and to show judgment and variety in its selection of speakers and films. This year's students on their own volition organized the first student art exhibition and competition; it was surprisingly good and will get better.

When we adopted the new program in liberal education we abolished English composition as a formal required subject. We now rely on a good deal of writing in the core course and careful criticism of this writing. This has worked out well.

However, there is a demand for training in specifically professional writing. Professor Robert R. Rathbone of the Department of Humanities offers such courses which are not credited against the allotment for time in the humanistic-social science subjects but rather against the professional allotment. Thus depart-

ments which ask for them really want them, and the students behave accordingly. Professor Rathbone manages individual conferences with upperclass students on reports which are in their own fields and which are of primary importance in their technical education. In four first-term Course VI subjects he has met in conference 112 seniors. Fifty Course II seniors received the same type of instruction in Engineering Laboratory. In addition, twenty Course II seniors worked with him on their theses from the time they made their thesis proposal to the completion of an acceptable rough draft. During the second term the numbers were 80 in Electrical Engineering (60 were continuing for the second term), 40 in Mechanical Engineering and 25 theses. As a result of this work, 222 seniors out of a total class of 707 received instruction in this type of writing. The Department would do well to expand the scope of its work in technical writing to other professional departments and to students in the junior subjects which lend themselves to this type of instruction, but we can do so only when professional departments feel the need and ask for the service.

In the last analysis M. I. T. students, like other young (and old) Americans, know how to use better language than they always employ. Verbal manners, like other manners, cannot safely be put on only for Sunday occasions. This School can make only a beginning contribution to the final competence. If bad or clumsy or unclear English is permitted in other subjects (or in upperclass Humanities subjects, for that matter), the natural sloppy tendencies of most of us will prevail. Neither we nor perhaps any American college has really come to grips with this problem.

Research. It is quite impossible in a report of this length to cite all of the research work in this School. Here I can mention only a few examples.

Speech analysis research, in which an attempt is made to analyze spoken language into its component sounds and then to measure the individual sounds, has been under way in the Department of Modern Languages since 1946. Under the direction of Professor Morris Halle, instrumentation has been developed which discriminates between some classes of English sounds on the basis of physical measurements. Continuing research will attempt to find other significant parameters leading to identification of each

sound of English and other languages. This year the Department has also taken a more active interest in machine aids to translation. It is of course the development of modern computers with large-scale storage which makes translation by machine possible. These computers are capable of all the requisite logical processes. The major problem is not the design of a machine but the study of the languages involved. Completely objective vocabulary and syntax studies must be made. Only then will it be possible to program a computer to turn one language into an acceptable approximation of a second language.

Both the speech analysis and the machine translation projects represent a particularly attractive sort of research in a Department of Modern Languages at M. I. T., for they involve new applications of the techniques of the natural sciences to a human activity. At some time in the future it seems reasonable (granted progress) that the two projects will join forces. If and when this happens, the spoken language may be brought back to an importance it has not had since the invention of printing and the consequent development of the written language which with its own peculiarly archaic conventions dominates most important human communication today.

It is hard to realize that this year the Industrial Relations Section will publish its seventeenth annual report (available from the headquarters of the Section). The framework for study of the process of wage determination worked out earlier by Professor George P. Shultz and Mr. Irwin L. Herrnstadt has been tested by an intensive study of several local unions in the New England textile industry. Professor Shultz has studied the operation of the so-called Slichter Law for the settlement of emergency disputes in Massachusetts and Professor John R. Coleman has continued to study worker participation in the local union, focusing on one of some 1,200 members in the Boston area. Professor Paul Pigors has continued to expand and refine his concept of the "incident" method of studying personnel policies and methods. Thirty-six companies are now experimenting with the method and it is also being used in the Armed Services and in various government agencies. The incident process is one by which the members in training learn by doing, in accordance with the oldest traditions of M. I. T.

The work on industrial relations in other countries has expanded both in its nature and because of the existence of the Center for International Studies at M. I. T. Professor George B. Baldwin has been in India making case studies of the development of industrial enterprises in the Bangalore area. Mr. John C. Eddison was in India during the past year on a Ford Foundation fellowship for a study of the growth of the paper-making industry, including its labor problems. The Ford Foundation has made a grant to a co-operative project on "The Labor Problem in Economic Development," involving studies in six countries by staff members of the industrial relations centers at the University of California (Berkeley), the University of Chicago, Harvard University and M. I. T. Part of M. I. T.'s task will consist of a joint study with the University of Chicago of managerial organization and policies in certain countries of Western Europe; the problems in India will be the particular concern of M. I. T. This work is under the direction of and directly participated in by Professor Charles A. Myers.

The most important development in the Center for International Studies was the receipt at the end of the year of a very substantial grant from the Ford Foundation for the conduct of research in the field of economic development. The purpose of this study was described in my report a year ago and is contained in detail in the annual report of the Center, which may be obtained on application. The grant from the Ford Foundation removed a major uncertainty which had hovered over a portion of the Center's forward planning and has thus freed several senior men for full-time attention to substantive research. Research on economic development which had been in the planning stage for two years with the aid of interim grants will now take its place with the two other areas of interest for which long-term financing had already been secured, international communications and problems arising out of America's relations with Russia and with the Soviet bloc. These three programs define fairly clearly the Center's activities for the next few years.

Despite the generosity of its grant, the entire program on economic development supported by the Ford Foundation calls for more financing than the Foundation finally decided to provide. The Center will therefore have to seek additional financing before it can proceed with its studies of the technological alternatives open

to labor-surplus countries and of the political and social developments associated with economic development. The study of technological alternatives would be particularly appropriate for M. I. T.

The Center tries not only to conduct research in Cambridge but to encourage the growth of such research in selected foreign countries and this has required and will continue to require a considerable amount of travel abroad. The Center's director, Professor Max F. Millikan, visited Italy, India and Indonesia during the fall and made specific co-operative arrangements with interested authorities of those countries. The India project headed by Professor Wilfred Malenbaum will soon take much of its work to the field as will the Italy project directed by Professor Paul N. Rosenstein-Rodan.

A major product of the Indonesia team's recent work has gone into construction of a set of basic social accounts for the country. The Indonesian project has been fortunate in developing close collaboration with the Indonesian political project at Cornell University, the Indonesian resources project at Yale, and the Institute of Islamic Studies at McGill. The Center also supported an eight-man field team of anthropologists in Indonesia, led by Rufus S. Hendon of Yale University. In addition to work in these three countries, Mr. Everett C. Hagen, formerly senior economic adviser to the Government of Burma, has completed a historical study of the Burmese economy. The Center has also supported jointly with the University of Rangoon a number of studies of the present structure of Burmese economy; these are directed by Professor Tun Thin, Chairman of the University's Department of Economics.

The international communications program directed by Professor Pool has completed its second year under the four-year grant from the Ford Foundation. A trade study directed by Mr. Raymond A. Bauer has interviewed many leaders of business, politics and the press with a view to learning how public opinion was formed on the issue of extension of the trade agreements act in the spring of 1954. Professor Daniel Lerner has led a study of the communications forces which are influencing the leaders of French opinion in the direction of neutralism on the one hand or toward European co-operation on the other. Professor Pool paid a two-month visit to India in the spring of 1954 to get the third major study of the communications program under way.

A substantial but minority share of the Center's energies continues to be devoted to studies concerning relations with the Soviet bloc and the free world. Major studies which are nearing completion include a comprehensive analysis of Chinese Communist society directed by Professor Walt W. Rostow, a study of the techniques and problems of the Soviet take-over of its European satellites directed by Mr. James E. Cross, and an analysis of forced labor within the Soviet Union by Mr. Alexander G. Korol.

It is evident that it is disadvantageous for the Center to be so completely dependent on short-term ad hoc financing. It will always be necessary to have a considerable amount of specific project financing, and this will be desirable; but the Center does need some measure of permanent financing to assure stability and to guarantee a minimum number of full-time long-term appointments to assure continuity of its work. The Director and his senior staff have taken this as a primary problem with which to deal in the near future.

The research activities of the members of the Department of Economics and Social Science involve every man on the staff, and I shall not try to cite them all here. Professor Robert M. Solow has been doing new work in the field of linear programming for The Rand Corporation and in connection with M. I. T. committees on Operations Research. Professors Robert L. Bishop and Morris A. Adelman have been participating in studies financed by The Merrill Foundation in the area of price policy. Professor E. Cary Brown has been a consultant on fiscal policy to the Committee for Economic Development. Professor Adelman is a member of the Attorney General's committee to study anti-trust laws. Professor James E. Boyce is a consultant to the United States Government on Burma. Professor Charles P. Kindleberger has spent the year in Geneva studying the terms of trade of Europe under a project financed by The Merrill Foundation. Professors Harold A. Freeman, Paul A. Samuelson, Solow and Licklider are all editors of one or another important professional journal in their respective fields.

Professor John B. Rae of the Department of Humanities has received a grant from the Harvard Research Center for Entrepreneurial History and has been devoting part of his time to research on the topic of the engineer as businessman. This will continue with the assistance of funds from the School of Industrial

Management. Professor John M. Blum has undertaken with Mr. Henry Morgenthau, Jr., to write an account of the latter's activities during the period he served as Secretary of the Treasury. Professor Karl W. Deutsch received a fellowship from the Guggenheim Foundation to assist him in a study of the development of the idea of political community in Switzerland. Professor Leslie H. Fishel, Jr., has served as research associate in a project studying the history of the activities of the Federal government in science. Professor Gregory Tucker was commissioned by the Creative Concerts Guild to compose a cantata on a poem by Dylan Thomas.

Personnel. New appointments included those of Charles W. Rosen as Assistant Professor of Modern Languages, Lacey B. Smith and Alfred D. Chandler, Jr., as Assistant Professors of History, and Harald A. T. O. Reiche and William D. Stahlman as Carnegie Fellows.

Professor W. H. Sterg O'Dell resigned to accept the post of Academic Dean at Colorado College. Professor C. Conrad Wright resigned to teach at the Harvard Divinity School, Mr. Howard J. Thompson to be an instructor at Cornell College in Iowa, and Mr. Richard M. Markus to begin his career as a lawyer in the Department of Justice. Mr. Charles W. Steinmetz also left M. I. T. for government service.

Mr. Edward G. Bennion of the Standard Oil Company of New Jersey has been a Visiting Professor this year — replacing Professor Kindleberger who was on leave — and has made a significant contribution to our teaching and thinking.

Professor Deutsch was on leave for the first half of the year to complete his work at the Center for Research on World Political Institutions at Princeton University.

Not the least important visitors are those who come here in person to make music and those who come visually through their works of art. Among the musicians we have welcomed have been Leslie Chabay, tenor; Melville Smith, harpsichordist; Ernst Levy, pianist; the Loewenguth String Quartet; and Professor Rosen, pianist. Among the many interesting exhibits prepared under the direction of Professor Beckwith we had the paintings of four young Americans, T. Lux Feininger, David Park, Ralph Coburn and Emerson Woelffer; an exhibition of the watercolors of the late

John Marin; a comprehensive showing of the painting of our own Professor Kepes; and a one-man show of the metal sculptures, paintings, graphics and chairs by Harry Bertoia, one of the outstanding abstract sculptors and designers in this country.

Unfinished Business. I have in general indicated the major problems which the School needs to solve and repeat them briefly here. We need a better integration of the Center for International Studies with the academic programs of the Institute; and directly related to that need is the other need for permanent financing for this manifestly successful activity. We need new financing to set up a stable effort in psychology along the lines of the Marquis report, and further financing to establish the new work in art along the lines of the Hayes report. We need to achieve a better coordination of the teaching offerings of the many political scientists in this faculty housed as they are now in three separate administrative units. We need to begin the development of a drama program for students which will have the same toughness and excitement that is evident in the music program, a combination of first-class teaching of drama as literature in the classroom with first-class presentation of drama as active theater in the new facilities which will be available in the coming year.

In my judgment we need a very serious review of what we are doing in modern languages, but this is a review of a national dimension. It is simply ostrich-like for Americans to pretend that English will carry them successfully everywhere in every kind of negotiation which our world influence now demands. If there ever was a time when it was necessary for the world that many Americans have genuine command of languages other than English, it is now. Yet the evidence is that if anything is happening, it is the reverse of this. At M. I. T., as at many institutions, we have no requirement of language for admission though it is recommended. Our language requirement for graduation varies with the departments and is in my judgment capricious, nor does it in any event ever extend far enough to ensure that a student who meets it will have any more knowledge of the language than it is easy to forget in the first year of disuse. The requirement for graduate students is still more traditional in its nature. Language should not be dropped from M. I. T. curricula, but it should be made a serious

adult study and carried far enough along so that the man who has studied it has some chance of behaving better as a world citizen. This will involve a very close examination of every aspect of language training, both in school and in college, and it is high time that it began.

The School has again been immeasurably aided by the freedom to experiment permitted by the grant from the Carnegie Corporation, which unlike many foundation grants is not anchored to projects. Our own experience makes it pretty clear that this is the kind of financial support the humanities in America most need.

JOHN E. BURCHARD

School of Industrial Management

In 1951 M. I. T. received a generous grant from the Alfred P. Sloan Foundation, Inc., to create the fifth school, the School of Industrial Management. Basic to the decision to create a new school at the Institute was the belief that training in science and engineering is an invaluable asset in the education of industrial managers. By choosing these fields of science and engineering as the basis for the education of the industrial manager, the new school will be in a unique position to exploit the unsurpassed talents that are present at the Institute.

We must take full advantage of this great opportunity. We continue to struggle, to an increasing extent successfully, with the challenge that a working knowledge of our complex and dynamic technology is an extremely fruitful path for the training of future industrial managers. We hope that the School of Industrial Management, dedicated to applying the findings of the social and physical sciences — as well as those of engineering — to the solution of problems of management, may also represent a step forward in reducing the gap between these sciences. We would thereby

contribute to harnessing the almost unlimited energies released by the progress of science over the past fifty years.

As is often true in educational advancement, the problems of implementing the promising thought underlying the creation of the new School have been vastly more difficult than the generation of the basic idea. Our problems this year have centered around developing a sound concept of teaching industrial management to exploit our resources in science and engineering, securing outstanding staff at all levels in sufficient numbers to assist in solving the meny problems that beset us, and extending the frontiers of knowladge in management problems and their solutions.

The past year has been a trying one. We have experienced setbacks and delays, particularly with respect to new appointments; nevertheless the twelve months have shown progress.

Twenty-nine men received the degree of Master of Science in Industrial Management at the June commencement. They had completed their undergraduate work in science or engineering in seventeen American universities and colleges and six foreign institutions.

This was a significant event, for it represented the completion of the present formal graduate program by the first group of students to enroll in the new School of Industrial Management. To the men themselves, the significance of being the first class so to graduate will continue to grow as the School develops and its reputation spreads. It was an important event to the Faculty also, for it represented to them the first run, as it were, of a School-fostered educational program for graduate students, which they had put together with care and were observing with attention.

I start my report with reference to this graduating group not because the graduate program had preferred attention among the elements in the School but because it represents a comprehensive step in M. I. T.'s evolution from Course xv into the new School of Industrial Management.

At the same commencement 77 men and three women received the Bachelor's degree in the undergraduate course in Business and Engineering Administration, and, in addition, the Master's degree was awarded to 34 Sloan Fellows.

Educational Developments. In my report of last year, my first as Dean of the new School, I pointed out that our schools of business, and particularly our schools of management, must be forever questioning their educational programs and methods in order that the training of young men interested in this field may keep pace with the evolving and enlarged concepts of the responsibilities of management in our industrial society. In the few decades in which industrial management has been recognized for the important thing it is, ever-increasing responsibilities have been demanded of it. No longer is the responsibility to owners for profits the only obligation of the industrial manager. Today there is also the recognition that management has responsibilities to employees, to customers, and to the public at large. In our time management has become a high calling.

In keeping with the need for constant review and revision of our educational programs to meet these higher demands, the Faculty of the School has continued throughout the year its review of courses and fields of interest at all levels of instruction. Much has been contributed in the past to the development of good education in this field of management, both here at M. I. T. and elsewhere. We must build on this experience while at the same time seeking new subject matter and better ways of teaching. Already some notable changes have taken place and hold considerable promise. We have every reason to anticipate that the coming year and years will result in further progress in the development of a curriculum designed to meet the needs of a School of Industrial Management at M. I. T. and, indeed, to meet the needs of industrial management in our complex world.

In our endeavors to develop a program of instruction responsive to the realities of the industrial world, we must obviously pay due regard to the practices and habits of today's successful managements. But today's successful practices have evolved out of those of yesterday — often in a quite different fashion. Tomorrow's new and more successful practices will evolve out of today's efforts. Therefore great emphasis must be placed on the principles which underlie the constant changes in our dynamic industrial operations. Thoughtful men both in industry and in academic life are coming to understand better these underlying principles. The schools of

management are rightly expected to take leadership in these studies and in developing methods of analysis.

This is but part of the story. While industry is changing its internal operational procedures and finding better ways of doing its job which are proper subjects for research and teaching, our future industrial leaders must become aware during their student days of the changes occurring in the environment in which industry exists. These developments — not only economic but social as well — have vital impact on management decision-making. They involve new standards of ethics, changed attitudes toward government and an increasing regard and respect for the dignity of labor and the individual worker at all levels of responsibility.

And here, too, the schools of management are expected to take leadership in recognizing these changing concepts. Only by so doing will they achieve in their field the recognition accorded the great schools of law, engineering and medicine.

Earlier I have mentioned and confirmed our faith in the value of studies of mathematics, physics and engineering as a basic, sound discipline for students planning a career in the field of management Our undergraduate students receive this at M. I. T., and our graduate students come to us having majored in some field of science or engineering. The rationale underlying our current core curriculum in management subjects can be described briefly as follows: the fundamental tools for grappling with management problems consist of thorough grounding in accounting as a control device, statistics as an aid to managerial decision-making and the usefulness of incremental analysis as applied to profit maximation. These tools are then utilized in developing an understanding of the functional fields — production, marketing, finance and industrial relations. Certain of the relationships of industrial management to government are developed in the new law courses where the law is taught as a procedural and environmental process; the significance of change is elaborated in our work in industrial history; the relationship of the individual to society is developed in our work in human behavior. Finally, the application of this entire body of knowledge to management decision-making is developed in our administrative policy courses and in our organization courses.

These are but some of the results of our studies of the educational program. In passing I want to record the enthusiastic sup-

port and interest which has come from all ranks in the Faculty in devising constructive improvements in our educational efforts.

The program of the past year has been characterized further by the contribution made by men from industry, education, labor and government who have participated actively in work with students. These men coming from busy careers made a worthwhile, complementary experience for the students; they were particularly helpful in developing a realization of the many intangibles and imponderables that exist in managerial decision-making at all levels. Professor Mason Smith brought to his course in administrative policy a wide experience in consulting on management problems in a variety of industries. Likewise, Mr. Wroe Alderson, who left his firm of Alderson and Sessions to be with us for a term as Visiting Professor of Marketing, brought to us a scholar's mind encased in years of practical experience in these areas. Others from industry conducted seminars for short periods or intermittently throughout the year. Altogether there were over sixty men from the world of affairs who were associated with the School in one or more sessions. All students — undergraduates, graduates and Sloan Fellows—had varying amounts of exposure to this valuable experience as a result of the visits of these men who so generously supported us. While we have made great progress in learning how to assimilate these people into our basic educational program, we continue to strive for the optimum use of the talents which these men make available to us.

It is a pleasure to record the whole-hearted cooperation of members of the Faculty of the Schools of Science, Engineering and Humanities and Social Studies in recognizing the problems and goals of students in this School. We have made heartening progress in developing a sense of understanding so imperative in an academic institution. It is to be hoped that the rate of progress in communications between scholars in the various other parts of the Institute and those in the School will continue with the passage of time.

A discussion of our relationship to other parts of the Institute would not be complete unless I included a note of special gratitude, as I did last year, for the extensive and invaluable assistance rendered to us by the members of Professor Ralph E. Freeman's department. We are indeed fortunate at the Institute in having

understanding and cordial relations between the School of Industrial Management and the Department of Economics and Social Science.

In return for the many great teaching services rendered to us by other staff members, the Faculty of the School has in its classrooms and seminars two students registered elsewhere in the Institute to every three registered in this School.

Faculty Activities. The building of a school is essentially the building of a staff. In common with others who desire to break new ground, we have found our personnel search hampered by an acute shortage of properly qualified and available staff members. In view of this immediate obstacle, we have sought to interest imaginative scholars who are attracted by the challenge which our academic goals afford.

Since the start of the new program five appointments have been made at the professor and associate professor levels: those of Eli Shapiro, Mason Smith, Elting E. Morison, William A. W. Krebs, Jr., and Joseph A. Pechman.

We shall have joining us this fall Professor Douglas McGregor, formerly President of Antioch College and a leader in studies in human behavior, and Professor B. E. Goetz who comes with extensive experience in industry as a consultant in many phases of management and production problems as well as having extensive teaching experience in a number of Midwestern colleges.

Mr. A. B. Jack joins our marketing group as Assistant Professor and comes with both industrial and teaching experience. We are also fortunate in having during this coming year Dr. David Durand, one of the foremost financial statisticians in the country, as Research Associate.

Mr. Roger Burlingame joins the staff for the fall term as Lecturer in industrial history and Mr. Lounsbury Fish will conduct a series of seminars in organization studies throughout the coming year.

Professor Joseph Pechman came to us from the Treasury Department, and after a year of notable contribution he has been called back to Washington with a year's leave of absence to fulfill

an important role in the Council of Economic Advisers to the President.

Promotions to assistant professorships have been made to Thomas V. Atwater, Jr., Edward H. Bowman and Albert H. Rubenstein. The latter has received a Fulbright Award and will be on leave of absence for one term this coming year.

A faculty makes its contribution to the objectives of a school not only through its work in the classroom and its associations with students but in two other important ways — in the publication of the studies and researches of its individual members and in the offices they hold and the services they give to groups, associations and governmental agencies.

The current publications of the staff are included elsewhere in this annual report. I want to record here some of the more important outside activities of the members of our staff, contributing to the common good.

Professor Krebs is acting as executive secretary of a New England Committee on Atomic Energy. Professor Erwin H. Schell has acted as advisor to the Tenth International Management Congress held in Sao Paulo, Brazil, for the Comite Internationale Organization Scientifique. Professor Pechman has been an active advisor to the Treasury Department and has served on the Executive Committee of the conference on Research in Income and Wealth of the National Bureau of Economic Research. Professor Thomas M. Hill is serving as Chairman of the American Accounting Association's Committee on Concepts and Standards. Professor Smith is Chairman of the Research Committee of the National Association of Cost Accountants. Professor Robert B. Fetter was consultant to the Netherlands Technical Assistance Team on Production Planning and Control. Professor Shapiro was appointed to the Joint Committee on Education, representing the American securities business. He is a member of the editorial board of the *Journal of Finance.* Professor Myron J. Gordon is a member of the American Accounting Association's Committee on National Income Accounting.

Within the policy of M. I. T. in such matters, members of the staff are frequently called upon by industrial firms for consulting purposes. Often they assist in formulating important policy deci-

sions. Properly chosen assignments of this nature contribute to the professional development of all our staff.

Executive Development Program. The notable event of the year in this Program was the addition of a second group. The two groups, each of seventeen men, were handled individually in all respects under the guidance of Professor Gerald B. Tallman, the Director of the Program. One of the valuable experiences of these men during their twelve-month stay at the School has been the social life that they develop for themselves. Any fears that two groups might complicate this important aspect of the program were unfounded. Not only do the Sloan Fellows leave here with a deep conviction of the worth-whileness of their course, but the wives also testify to the value of the experience to them.

We shall continue with two groups for the 1954–55 academic year.

The short summer course in "Control Problems of the Executive" was given for the second year with Professor Smith in charge. This continues to be an experimental project to attempt to serve industry and middle management, shorter in time than the twelve-month Sloan Program.

We anticipate having more short programs in different areas as a service to industry in developing managerial talents. Several new courses are now under consideration.

Research. If the School is to acquire equal status with the other schools of the Institute, it must establish its position in the field of research. But research and contribution to knowledge are not easily obtained. Outstanding and sufficient personnel, an environment of stability and dedicated devotion to scholarship are all integral ingredients of the research process.

Research is, at best, a discontinuous process. In our School it has been hampered by the great demands made upon our small staff to develop a curriculum, to orient itself to the engineering resources at our disposal and to meet the needs of our students for help in the transition from their engineering or science backgrounds to industrial management.

A start in a number of directions has been made possible by funds available to us from the Alfred P. Sloan Foundation. The

income from these funds has permitted individual staff members to pursue their interests in particular fields. These research interests of members of the staff encourage the spirit of inquiry in the classroom, enliven the instruction and enrich the course content.

A significant contribution to our research program this year has been the joint research endeavors of our School and other parts of the Institute. In conjunction with the Mechanical Engineering Department, we undertook to produce an exploratory study on the credit transfer problem. Several members of the School have been at work with members of the Electrical Engineering Department on the business implications of electronic milling devices. Other staff members have been working with representatives of the Mathematics Department on problems pertaining to the optimum length of an assembly line. We are all greatly encouraged by these developments and anticipate an increased growth in the number of such projects.

In addition to these projects, which have received financial support from the income from the School's present research funds, there is another category of research which should be mentioned. I refer to the proposed research inquiries involving investigation into broad and complicated questions of management policy and economic policy. In this connection, various members of the staff of this School, together with members of the Department of Economics and Social Science, have been at work. The exploratory work for a large-scale project in the area of management development has been under way for six months. In addition, a group of studies, involving complex questions and covering a broad terrain of economic policy, have been explored in the area of profits. Much work has been done in this important field by others, but it is believed the studies under consideration will produce further knowledge and rewards. Financial support for major endeavors such as these two will be sought from outside sources, and we have reason to believe such support will be forthcoming.

Professor Ronald H. Robnett. The School, and I personally, suffered a great loss in the untimely death of Professor Ronald H. Robnett. He had served as Associate Dean for nearly two years and his contribution to the early planning for the School was of distinct value. His loss is being felt by his associates and particularly by

me, to whom he brought a wealth of knowledge of academic matters and great skill in dealing with Faculty and students. Through the generosity of his former students and associates, a Graduate Lounge is being furnished in his name to perpetuate his great interest in the important social side of an educational experience.

E. P. BROOKS

School of Science

The six departments of the School of Science vary greatly in size — from Physics and Chemistry, which are among the largest and oldest departments in the Institute, to Food Technology, which is much newer and smaller. The individual problems of these departments vary slowly in accordance with trends in each scientific field, the importance to the worlds of scholarship and commerce of particular developments and the reactions which make new facilities and personnel available. These variations are superposed on the constantly growing scientific needs of the Institute, the nation and the world.

The science departments are adequately housed, except for badly needed space to accommodate those portions of physical research still in temporary buildings left over from World War II. It is very gratifying that a new physical sciences building, to be erected as a memorial to Dr. Karl Taylor Compton, is now being made the subject of an intenaive campaign whose successful completion should give us an outstanding plant and facilities for our entire scientific effort. In addition, this will greatly further co-operation with related activities in the other Schools.

Facilities. Much progress has been made in adjusting departmental activities to our new quarters in the Dorrance Building. An important new multicurie radiation facility, consisting of mixed fission products, has been provided by the Atomic Energy Commission for use in the food sterilization program of the Department of Food Technology. This is now housed in a special food irradiation laboratory. The new air-conditioned animal quarters have proved very satisfactory and have given impetus to staff research in

the evaluation of food processing and of chemicals used in foods and in nutrition.

Since the establishment of the Division of Biochemistry last year its instrumentation and equipment has been further augmented. The Division is now superbly equipped for efficient and large-scale operations in a variety of biochemical fields.

Substantial improvements in teaching and research space were made in the Department of Geology and Geophysics during the summer of 1953. The three separate parts of the Lindgren collection of minerals and ores were brought together in a room on the ground floor of Building 24. This well-known collection, one of the Department's most valuable assets for instruction and research in mineral deposits, is now an important adjunct to our new Geochemistry Laboratory. This was developed by combining special facilities, made available on the termination of the American Petroleum Institute project on the origin of oil, with other facilities constituting the former mineral deposits laboratory. This laboratory fills a pressing need for instruction and research in geochemistry, a rapidly growing field of earth science.

A new laboratory for instruction in petroleum geology was made possible when the Lindgren rock collection was moved from the fourth floor of Building 24. Part of the furniture and all of the important maps housed in the former Schwarz map room in Building 4 were moved into this laboratory, and during the fall term, for the first time, adequate maps and other teaching materials were made available for an instructional program in petroleum geology. A new grinding and screening laboratory was installed on the ground floor of Building 24 to meet the demands of increasing student and staff research on the radioactivity of minerals, rocks and ores.

Personnel. Professor Richard S. Bear, who has served ably as Executive Officer of the Department of Biology for the past three years, relinquished this post to Professor Irwin W. Sizer at the end of the year. The duties of Undergraduate Registration Officer in biology, which had been shared by Professors Charles H. Blake and Bernard S. Gould, will now be undertaken entirely by Professor Gould. Faculty changes in biology involve primarily the resignations of Doctors John H. D. Bryan and Edith MacRae, Instructors,

and the appointment of Dr. Mac V. Edds of Brown University as Visiting Associate Professor of Biology, in charge of the course in Vertebrate Embryology.

Professor Don M. Yost of the California Institute of Technology held the second Arthur D. Little Visiting Professorship in Chemistry and delivered a series of twenty lectures in the field of inorganic and physical chemistry during the fall term. Sir Alexander R. Todd of Cambridge University, England, will hold the third Arthur D. Little Visiting Professorship during the fall term of 1954. Professors Charles D. Coryell and John C. Sheehan have been on leave of absence during parts of 1954. The former delivered a series of lectures at the Weizmann Institute of Science in Rehovoth, Israel, while the latter served as Scientific Liaison Officer for the Office of Naval Research with headquarters at the U. S. Embassy in London. During his leave Professor Sheehan visited many laboratories in Europe and the Near East.

In order to amplify our instruction and research in geochemistry, a geological science that is now growing rapidly, Dr. Herbert Hawkes, for the past thirteen years a geochemist in the U. S. Geological Survey, was appointed Lecturer to organize and supervise a program of lectures and laboratory investigations utilizing the facilities of our new Geochemistry Laboratory.

Professor Warren J. Mead, Emeritus Professor and Lecturer since July, 1949, who has been lecturing in engineering geology and in structural geology during the year, retired as Lecturer at the end of the spring term. Dr. Mead came from the University of Wisconsin to M.I.T. in July, 1934, to take charge of the Department of Geology. Under his able administration new curriculum changes were made, a departmental shop was installed, and many new improvements in departmental facilities were introduced.

Professors Witold Hurewicz and Raphael Salem in the Department of Mathematics spent the fall semester on leave on Guggenheim Fellowships, Professor Hurewicz at the Institute for Advanced Study in Princeton and Professor Salem at the University of Paris. Professor Warren Ambrose spent the year on leave, lecturing during the fall semester at the Tata Institute of Fundamental Research in Bombay, India, and spending the spring semester at the University of Paris pursuing research in the field of differential geometry. In January of this year, Professor Norbert Wiener, at the

invitation of the Indian Government, spoke at the 1954 Indian Science Congress and gave lectures at various universities throughout India. During the summer of 1953 Professor Kenkichi Iwasawa was a participant in the Summer Institute of the American Mathematical Society devoted to work in the field of Lie groups and Lie algebras.

In the Physics Department, Professor Martin Deutsch spent the year at the College of France on a Fulbright Award. Professor Bernard T. Feld, with both a Fulbright Grant and a Guggenheim Fellowship, spent the year in Italy at the University of Rome. Professor Robert S. Williams spent the year on leave as a Visiting Assistant Professor at Princeton University.

Undergraduate Courses and Curricula. The growth of the Department of Biology has for some years made some division of administrative responsibilities seem desirable. This led to the commissioning of the Division of Biochemistry under Professor John M. Buchanan two years ago, which now operates smoothly as a separate unit within the framework of the Department. During the year members of the staff whose training and interests lie chiefly in Biophysics and Biophysical Chemistry met each week and succeeded in formulating a curriculum revision in this field. These professors, acting as a Committee on Biophysics with Professor Richard S. Bear as Chairman, will undertake to guide the teaching and research in biophysics.

During the spring term the Biology Department offered for the first time a freshman elective course: 7.00, Perspectives in Life Sciences, taken by forty-three students. Professor Richard C. Sanborn was in charge of this course, but all of the Department Faculty participated in giving the lectures. The Department welcomed this opportunity to extend its teaching activities to students who were not likely to enter the field of biology professionally. The Geology Department also offered for the first time an elective subject in Earth Science, 12.00, in the fall term. Fifty students attended the lectures, and answers to a voluntary questionnaire circulated at the end of the term showed strong approval for continuation of Earth Science as an elective subject. An elective subject for freshmen offered by the Mathematics Department for the first time during the fall semester had a gratifying response, and as a result three sections of the subject were offered. Since one of the

purposes of the freshman elective system is to enable a student to broaden his interests rather than to specialize his knowledge, the Department decided to give its elective subject in the field of Theory of Numbers.

The major effort during the past year in the improvement of the undergraduate curriculum in biology was devoted to a revision of the courses in biochemistry and general physiology. Out of many discussions has emerged a new integration of these two subjects into a two-semester senior course called General Biochemistry and Physiology, which it is hoped will cover a broader field in a more efficient coordinated manner than was possible heretofore, when the subjects were dealt with separately. The two lecture courses are in the charge of Professors John M. Buchanan and Francis O. Schmitt, with the active co-operation of all members of the staff. The associated laboratory courses will be under the direction of Professors Bernard S. Gould and Howard P. Jenerick.

In an effort to reduce the number of class hours for which freshmen are scheduled, the first-year chemistry curriculum was modified by the Faculty during the 1953–54 academic year. During the first semester the laboratory schedule was reduced from three to two hours per week, while during the second semester the recitation time was reduced from two hours to one hour per week, with an optional conference hour — scheduled by each recitation section instructor — replacing the omitted recitation hour. The staff members concerned concluded that these schedules were not fully satisfactory and that the schedule which had been used in recent years — comprising two hours of lecture, two hours of recitation and three hours of laboratory per week — forms a practical minimum for proper instruction in first-year chemistry at Institute standards. This matter is still under discussion by the Committee on Undergraduate Policy and will be reviewed by the Faculty during the coming year.

A committee of the Chemistry Department has reviewed the content of second-year chemistry, Qualitative and Quantitative Analysis, and has concluded that about half of the class and study time scheduled for qualitative analysis could be devoted advantageously to a survey of inorganic chemistry. There was common agreement that qualitative analysis provides the most effective laboratory approach to the subject.

The enrollment during the fall semester in mathematics was the highest in the history of the Department, the previous maximum having occurred in the fall of 1947. A significant difference is the increased enrollment in the upper division and beginning graduate subjects.

In last year's report, mention was made of a plan to permit suitably qualified students to cover the essentials of the six-term sequence, M11, M12, M21, M22, M351, and M352, in five terms, by replacing M21 by a new subject, M211, and following M211 by M351. A number of superior students availed themselves of this opportunity during the year, and the Department plans to continue to offer the same opportunity during the coming year.

The first- and second-year teaching effort of the Physics Department made significant progress during the year, especially in regard to the effectiveness of the laboratory instruction. The long-range program of improving the quality and facilities of the first- and second-year laboratories is progressing most satisfactorily. Marked improvement in teaching methods for these laboratories has been effected, and the contribution and morale of the teaching assistants engaged in this effort have reached a new high. Professor S. C. Brown gave an invited talk on these improvements in laboratory instruction to the American Association of Physics Teachers which evoked nation-wide favorable comment.

A special version of freshman physics (8.02S), referred to in last year's report, was repeated this year with very satisfactory results. During the last week of the spring semester, just prior to the examination period, the 8.02S laboratory experiments not normally done in 8.02 were made available to all freshmen on a voluntary basis, but without credit. The fact that about 20 per cent of the freshmen took advantage of this opportunity with great enthusiasm is most significant.

The major revision of the undergraduate curriculum, referred to in last year's report for Course VIII, has been approved by the Faculty and will be put into operation this fall. Particularly noteworthy are the drive and enthusiasm of the students in connection with the junior and senior laboratory subjects. The excellence and effectiveness of this phase of the undergraduate teaching is due in no small measure to the impact of the research program of the Department, both by virtue of modern experimental facilities which

are loaned by the research laboratories and by the highly enthusiastic research spirit which is brought into the undergraduate instruction by the members of the Faculty who pursue significant modern research.

Graduate Courses and Curricula. The five-year courses, VII-A and VII-B, which led simultaneously to the Bachelor's degree in Quantitative Biology and the Master's degree in Physical or Chemical Biology, have been discontinued in favor of revised Master's programs in Biophysics and Biochemistry. It is believed that these new programs will permit greater flexibility in the student's selection of courses and for the first time will permit students who were not undergraduates at M.I.T. to work toward a Master's degree in Biophysics or Biochemistry. Professor Myles Maxfield's graduate elective course in Mathematical Biophysics, given tentatively this past year, will probably be added to the list of permanent courses.

A new graduate course in food technology entitled Food Industry Seminar was organized and presented for the first time this year. At this seminar fifteen outstanding technical leaders in the food field gave lectures which were very effective. Formal approval of granting the doctorate in Biochemical Engineering was given this year by the Committee on Graduate School Policy.

In June, 1954, the first Master's candidates in Course XII-B, Geophysics, were granted the new degree, Master of Science in Geophysics, which had been authorized in June, 1953. With this degree now available, the departmental policy has been changed to the practice of enrolling all incoming graduate students in geophysics for this degree as a first step toward qualifying for the doctorate in geophysics.

As a result of present concern over the lack of adequately trained teachers of science, and the tendency for the more technically trained graduate students to enter professions other than that of teaching, a tabulation of former M.I.T. graduate students in geology was made by the Department to determine what contribution our own graduates have made to the teaching profession. It was found that of those whose highest M.I.T. degree was the Baccalaureate, 6.2 per cent are engaged in teaching, while of those

whose highest degree was S.M., 12.8 per cent, and of those having the doctorate, 29.4 per cent were engaged in teaching.

A survey made at the end of the past academic year of graduate students in chemistry revealed that the M.I.T. enrollment included 138 doctoral candidates from 115 different undergraduate colleges. Fifteen of these men were awarded National Science Foundation Fellowships.

Special Summer Courses. In July a most successful Special Summer Program in Food Technology was presented by the complete Faculty of the Department. This was attended by approximately 50 people representing nine countries.

The Special Summer Programs in Infrared Spectroscopy were presented under Professor R. C. Lord's direction for the fifth year. The total number of industrial, academic and governmental spectroscopists who have received part of their infrared training from these courses has now reached nearly 400. Among those who assisted in the presentation of the 1954 programs were Dr. F. A. Miller, Mellon Institute; Professor M. K. Wilson, Harvard University; Professor H. W. Thompson, Oxford University; Dr. W. C. Price, King's College, London; Dr. A. W. Baker, Dow Chemical Company; and Dr. N. R. Trainor, Merck and Company.

The sixth M.I.T. Geology Summer Camp was held at the Nova Scotia Centre for Geological Sciences under the direction of Professors Walter L. Whitehead and Roland D. Parks. Twenty-two students took basic field instruction; six seniors worked on thesis problems; and eleven candidates for advanced degrees carried on thesis investigation. M.I.T., and particularly the Department of Geology and Geophysics, lost a good friend and strong supporter when the Honorable Angus L. MacDonald, Premier of Nova Scotia, died on April 13, 1954. Not only was he the provincial representative who made it possible for our co-operative educational program to begin in the summer of 1948, but he also maintained continuous interest in our activities throughout the years and always attended closing ceremonies when his duties permitted. Having come to the premiership from an academic career at Dalhousie University, Mr. MacDonald immediately foresaw the value of our experiment in international co-operation and aided greatly in making it a success.

For the third summer some of our graduate and undergraduate geophysicists participated in the student co-operative plan of Geophysical Service, Inc., working as helpers on geophysical field parties in widely separated areas across the western part of the country. A week of intensive orientation lectures and visits to petroleum research laboratories in Dallas, Texas, preceded field assignments. This important experiment in co-operative education, initiated in 1951 by G.S.I. and M.I.T. for the practical training of geophysicists, has attracted such favorable reaction that during the summer a total of twenty-six students from fourteen different colleges participated in the plan.

During the summer of 1953, with the co-operation of Professor Y. W. Lee of the Department of Electrical Engineering, the Mathematics Department conducted a Special Summer Program in the Mathematical Problems of Communication Theory with lectures given by Professor Norbert Wiener, Professors Robert M. Fano and Lee of the Department of Electrical Engineering, and Dr. Claude E. Shannon of the Bell Telephone Laboratories. During the same summer Professor George P. Wadsworth co-operated with Professor Philip M. Morse of the Department of Physics in a Special Summer Program in Operations Research, and Professor Eric Reissner co-operated with Professor J. P. Den Hartog of the Mechanical Engineeting Department in a special course on Advanced Strength of Materials. All three of these special programs attracted a number of persons from industry, business and government.

Research. The Faculties of all six departments of the School of Science are outstandingly active in research.

In the Department of Biology work continues on the basic structures of nerve and muscle and on the complex biochemical problems which control the behavior of living organisms, while in chemistry a large number of basic investigations are under way in many fields of organic, analytical, physical and inorganic chemistry.

In Food Technology the field of food irradiation, or cold sterilization, in which the departmental staff has pioneered, gained recognition this year to the extent that the U. S. Department of Defense has initiated a multimillion dollar program in which our group is playing an important part with some fifteen other co-operating universities.

Graduate research and instruction continues at the same effective level in the Department of Physics as in the past. The research contributions of this Faculty continue to be outstanding in a large number of fields. Of particular significance are new techniques which increase the precision of the older methods by at least an order of magnitude in the fields of nuclear spectroscopy, microwave spectroscopy and frequency standards. In planning for the future evolution of research in high-energy physics, members of the Department are engaged in a co-operative study and planning program with Harvard faculty members for a new particle accelerator of about 5 B.E.V. energy for the Cambridge area. Members of the Department also look ahead eagerly to the availability of a nuclear pile for research purposes at the Institute.

The work of the Spectroscopy Laboratory, operated jointly by the Departments of Chemistry, Physics and Biology, continues to comprise research in the spectra of atoms and molecules and the development of new spectroscopic equipment and techniques. As in previous years the Laboratory derives its chief support from governmental research contracts and industrial grants-in-aid. Among the results of studies in molecular spectroscopy have been the discovery of a highly-complex infrared spectrum associated with certain strong hydrogen bonds in crystals at liquid helium temperatures, and the observation of a 20-fold increase in the infrared absorption intensity produced by hydrogen bonding and molecular complexes. Other chemical investigations have involved high resolution infrared absorption spectra and the Raman spectra of glasses, vibrational spectra of deuterium compounds, and spectroscopic measurement of vapor pressures of alloys. New developments in spectroscopic techniques have involved the production of improved diffraction gratings and the devising of new instruments for the reduction of echellegrams, whose introduction from this Laboratory several years ago has resulted in widespread use in physics, chemistry and astronomy.

Foreign scholars carrying out research in the Spectroscopy Laboratory during the year included Professor Yoshio Tanaka and Professor Masao Seya, Tokyo University of Education; Professor R. K. Asundi, Benares Hindu University; Professor H. H. Günthard, Swiss Federal Institute of Technology; Dr. B. Nolin, Canadian National Research Council; and Sr. A. Foffani, Padua University.

Laboratory for Nuclear Science. Important improvements and additions made to the Laboratory's experimental facilities include a large cosmic-ray cloud chamber, now installed for a first set of experiments at the Brookhaven cosmotron site; completion and calibration of a 90° analyzing magnet for the O.N.R. electrostatic generator; adaptation of this generator for the acceleration of electrons and helium ions, in addition to protons and deuterons; the completion and use of a new scattering chamber for the study of proton- and deuteron-induced reactions with the cyclotron; the development of fast and efficient energy-sensitive gamma-ray detectors for medium and high energy; and introductory design studies for an improved synchrotron beam injector and for circuitry for improving the pulse-to-pulse stability of that machine. Most important data on nuclear spectrography can now be taken with great rapidity with our apparatus.

In cosmic rays experiments on the new fundamental particles have been emphasized. Most exciting has been the possible observation of the annihilation of a negative proton. Data that have been accumulated on S-particle events indicate that the secondary particle is probably a pi-meson. A modification of the original Fermi model concerning the origin of cosmic rays has been proposed to account for the similarities in the energy spectra of all components of the primary radiation. A proposed air shower experiment for examining the isotropy, energy spectrum and time variations of very large air showers has been carried through to the point where an optimum experimental layout has been designed and is in the process of installation at the Harvard Observatory site at Harvard, Massachusetts.

Studies have been completed by the chemistry groups of "fine structure" irregularities in the fission yield of U^{235} and on the effect of closed shells and shell perturbations in fission. In energy level studies new data concerning significant reactions have been accumulated. Studies in photo-induced reactions of interest include the continuation of photofission studies. A significant observation during the course of the year was the electric excitation of nuclei bombarded by protons of low energy.

Studies on positronium have continued actively. The ground-state Zeeman splitting was measured with enough accuracy to test sensitively quantum electrodynamical theory. Study of the

double beta decay of Ca^{48} has established the possible lifetime of 1.6×10^{17} years for this process, implying that no neutrinos are involved.

The research program with the synchrotron has involved precise measurements of the angular distributions, excitation functions and energy distributions of mesons produced by photo-excitation of nuclei. An upper limit has been set on the cross section of the production of mu-meson pairs which appears to eliminate the possibility of any strong non-electromagnetic interaction. Work at the synchrotron has also included the detection and measurement of proton, deuteron and triton yields from several elements; Compton and Thomson gamma-ray scatter from nuclei; neutrons and protons emitted in coincidence by nuclei bombarded with high-energy photons; and detailed measurements on the photodisintegration of the deuteron.

Theoretical studies have included an approach to the meson-nucleon and nucleon-nucleon interactions and work on the relativistic wave equations, on the covariant two-body equation and on the three-body problem. A theoretical investigation of special interest was carried out in collaboration with members of the Research Laboratory of Electronics following the discovery and measurement of the octopole moments of nuclei by R.L.E.'s Molecular Beam Group.

Outstanding Problems. The need for increasing numbers of scientists and the present unsatisfactory situation in the teaching of science in the secondary schools are problems which have been with us for some time and constantly increase in urgency. Fortunately, a nation-wide movement for improvement in secondary school science teaching is now gathering momentum, as evidenced by the fact that more than half a dozen meetings of national scope dealing with the problem have been scheduled for the coming year.

It is gratifying that significant progress is being made toward the acquisition at M.I.T. of a new physical sciences building, a facility that has long been urgently needed.

A need that has been felt even more acutely during the last few years than in the past is that of fellowship support for outstanding graduate students in biology as well as in geology and geophysics. While certain national foundations provide fellow-

ships for advanced graduate students it would be particularly helpful if a few additional fellowships were available for beginning graduate students.

A long-standing belief of the administration has recently been reinforced by a recommendation from the Visiting Committee of the Department of Food Technology, urging that means be found by which stabilization of fiscal problems of the budget of that Department could be assured. The Visiting Committee also expressed interest in having the Department Faculty make some teaching contact with food technology students earlier than the beginning of the third year. It is expected that this change in curriculum may be made in the near future, and active steps are now being taken with a view to stabilizing the Department's fiscal problems.

GEORGE R. HARRISON

Report of the Treasurer

In 1953–54 Institute operations stabilized very closely to the level of the preceding fiscal year, as shown in the following summary:

REVENUES AND FUNDS	1953–54	1952–53
Tuition and other income	$4,487,000	$3,806,000
Investment income	1,232,000	1,451,000
Gifts and other receipts	2,775,000	2,964,000
Contract allowances for indirect expenses	3,472,000	3,773,000
Auxiliary activities	1,727,000	1,679,000
Total	$13,693,000	$13,673,000
EXPENSES		
Academic	$6,157,000	$5,838,000
General and administration	3,491,000	3,501,000
Plant operations	2,318,000	2,656,000
Auxiliary activities	1,727,000	1,678,000
Total	$13,693,000	$13,673,000

The reimbursement for direct costs on research contracts of the Division of Industrial Cooperation, not included in the above table, was $15,240,000 in 1953–54 compared with $14,911,000 in the previous year; for the Division of Defense Laboratories the reimbursement was $17,248,000 in 1953–54 and $14,431,000 in 1952–53.

The increase in tuition income reflected the higher tuition rate effective in 1953–54 and the larger number of students at the Institute. Investment income was reserved for addition to capital funds to a greater extent than in 1952–53. Gifts and other receipts and contract allowances for indirect expenses were used as required to meet current expenses. An increase in departmental expenses,

salaries and wages resulted in an overall increase in academic expenses. Plant operating expenses were lower but substantial provisions made in the latter part of the fiscal period for special alterations were scheduled for expenditure after the close of the year under review.

The growth in the endowment and other funds of the Institute during the fiscal year is presented herewith:

	June 30, 1954	*June 30, 1953*
Endowment for general purposes	$32,929,000	$32,445,000
Endowment for designated purposes	13,129,000	11,207,000
Total of endowment	46,058,000	43,652,000
Other funds	21,953,000	20,181,000
Total funds	$68,011,000	$63,833,000

The transfer of unrestricted funds to capital and the addition of investment income to principal were the major sources of new endowment for general purposes. The Faculty Salary Fund was thereby increased in 1953–54 to $4,451,000 from $4,115,000. The initial instalment payments on the sale of the common stock of Arthur D. Little, Inc., held in trust for the benefit of the Institute, exceeded book value by $554,000; and this was included with endowment for designated purposes at the close of the year. The Paul W. Litchfield Scholarship Fund and the Lester D. Gardner Scholarship Fund were established by appropriations of Development Scholarship Funds. With the use of unrestricted resources, a fund for Physical Plant Maintenance of $600,000 was set up in the endowment funds for designated purposes, as a step towards the provision of an adequate capital fund to support and maintain the expanding plant of the Institute.

The gifts, grants and bequests to the Institute for the year 1953–54 in the table below do not include the trust bequest of Edmund Dana Barbour of more than a half million dollars that became distributable but was not received before the end of the fiscal year:

	1953–54	*1952–53*
Endowment	$760,000	$588,000
Buildings	274,000	15,000
Gifts for current use — invested	726,000	2,583,000
Industrial Liaison support	1,225,000	1,101,000
Other funds for current use	1,657,000	1,695.000
Total	$4,642,000	$5,982,000

Gifts for current use — invested declined in 1953–54 from 1952–53 because subscriptions to the 1949–51 Development Program were completed in large measure in 1952–53 and the second distribution from the estate of Mrs. Sylvia A. H. G. Wilks was received last year.

Gifts and bequests for endowment included receipts from the Kresge Foundation for the Kresge Endowment Fund, the Webster Foundation for the Edwin Sibley Webster Professorship, the Class of 1929 and the estate of Marion Westcott for endowment for general purposes, the Machlett Laboratories for research and the estate of Charles and Louisa Locke for the Faculty Fund. Contributions for the Jerome C. Hunsaker Professorship were received from Glenn L. Martin, the North American Aviation Corporation, the Goodyear Tire and Rubber Company, the Consolidated Vultee Aircraft Corporation, the Grumman Aircraft Company, the United Aircraft Company, and the Guggenheim Foundation.

The bequest of Edward C. Hall and gifts to the Development Fund were included in invested gifts for general current purposes. The Alumni Fund of $207,919, which increased from $189,000 last year, was the largest gift in invested funds for designated current use. Contributions received in 1953–54 from the Alfred P. Sloan Foundation were $275,000 for the School of Industrial Management and $167,460 for other purposes.

The total appropriations of $2,400,000 for the auditorium and chapel buildings and plaza on the west campus were expended in the amount of $1,246,000 through June 30, 1954, leaving $1,154,000 for future expenditures. During the year $250,000 was received from the Trustees of the Kresge Foundation in payment towards the original gift for the building program and $210,000 was transferred from unrestricted funds for this purpose. Major alterations for biochemistry were nearly completed in the Dorrance Building by the close of the year. A total of $118,000 of such capital alterations was charged to expense and added to educational plant in 1953–54. Unallocated construction costs were reduced to $189,000 by use of unrestricted funds. On June 30, 1954, the book value of the plant of the Institute was $34,417,000, an increase of $1,352,000 for the year.

The invested position of the Institute on June 30, 1953, and on June 30, 1954, is indicated in the following classification of the general and special investments at book and market values, which is exclusive of the investments of the M.I.T. Pension Association:

	June 30, 1954		June 30, 1953	
	Book Value	Market Value	Book Value	Market Value
General Investments:				
Bonds	$24,685,000	$25,122,000	$20,159,000	$19,715,000
Stocks	18,929,000	39,411,000	17,709,000	30,386,000
Real estate	10,852,000	10,852,000	11,484,000	11,484,000
Cash & commercial paper	3,219,000	3,219,000	5,156,000	5,156,000
Total	$57,685,000	$78,604,000	$54,508,000	$66,741,000
Special investments	4,387,000	6,032,000	4,645,000	5,552,000
Students' notes receivable	1,012,000	1,012,000	787,000	787,000
Grand total	$63,084,000	$85,648,000	$59,940.000	$73,080,000

The rate of income earned in 1953–54 on the funds sharing in the general investments was 5.15% on the average book value of the funds, compared with 5.00% last year. Four percent was allocated to the funds and the balance was added to unallocated investment income. The total investment income was $2,900,000, of which $1,231,000 was used for current expenses, $225,000 was added to principal of the endowment funds, $549,000 was added to fund balances for redistribution against current expenses, and $593,000 was added to the reserve of unallocated investment income bringing this reserve to $2,390,000. Operations of the dormitories and related activities resulted in an addition to the reserve for investment amortization which, with an appropriation of unrestricted income from funds, increased the reserve for this purpose to $711,000 on June 30, 1954. The expansion in the use of the Loan Fund during the year is shown by the increase in students' notes receivable from $787,000 to $1,012,000.

The investments of the M.I.T. Pension Association were $4,871,000 at book value and $6,123,000 at market value on June 30, 1954. The total assets of the Pension Association were $4,924,000 at book value at the close of the fiscal year, and the Teachers Insurance Fund was $695,000 on June 30, 1954. An independent study of the Pension Association as of June 30, 1953, was completed during the year which confirmed that the assets and liabilities of the Association and of the Teachers Insurance Fund were in actuarial balance on that date.

In recent years an increasing proportion of academic expenses and related operating expenses have been met with revenues or funds available on a year-to-year basis. With an expanded and more useful plant and a high level of active educational and research

operations, some provision needs to be made from current resources for the continuing expenses of future years. In further recognition that a significant part of expenses are met with year-to-year revenues, $200,000 was appropriated from current receipts to establish a fund for the long-term financing of these expenses. Gifts for endowment, funds available for allocation to capital funds and the reservation of revenues for future expenditures are all important in preparing for the tasks ahead.

JOSEPH J. SNYDER

SCHEDULE A

BALANCE SHEET
JUNE 30, 1954

INVESTMENTS

General investments:			
U. S. Government bonds		$11,081,842	
Other bonds		13,602,488	
Preferred stocks		194,894	
Common stocks		18,734,678	
Real estate (including $5,129,777 devoted to Institute use) and mortgages		10,852,293	
Commercial paper		3,492,631	$ 57,958,826
Less temporary investment of general purpose cash			273,903
	(A-1)		57,684,923
Investments of funds separately invested	(A-2)		4,386,931
Students' notes receivable	(A-12)		1,011,670
			$ 63,083,524

CURRENT AND DEFERRED ASSETS

Cash:			
General purposes		$ 2,210,716	
Restricted to certain research contracts		370,224	
Students' safe-keeping deposits		82,413	$ 2,663,353
Temporary investment of general purpose cash			273,903
Accounts receivable:			
U. S. Government	(A-13)	$ 3,001,679	
Other	(A-13)	216,616	3,218,295
Contracts in progress, principally U. S. Government	(A-14)		2,853,680
Inventories, deferred charges and other assets	(A-15)		917,656
Advanced to Division of Defense Laboratories			432,864
			$ 10,359,751

DIVISION OF DEFENSE LABORATORIES ASSETS

Cash ($1,513,767 in restricted accounts)	$ 1,684,794
Accounts receivable	1,697,749
Contracts in progress	2,428,154
Deferred charges	53,335
	$ 5,864,032

EDUCATIONAL PLANT

Land, buildings and equipment	(A-19)	$ 34,417,430
		$113,724,737

SCHEDULE A

BALANCE SHEET
JUNE 30, 1954

Invested Funds

Endowment funds:			
Income for general purposes	(A-3)	$32,929,233	
Income for designated purposes	(A-4)	13,128,629	$ 46,057,862
Student loan funds	(A-5)		2,808,887
Building funds	(A-6)		1,410,421
Other expendable funds:			
General purposes	(A-7)	$ 1,022,510	
Designated purposes	(A-8)	6,221,365	7,243,875
Unexpended endowment income for designated purposes	(A-4)		1,112,442
Agency and annuity funds	(A-9 & 10)		952,050
General investments—gain and loss account	(A-11)		3,497,987
			$ 63,083,524

Current Liabilities and Funds

Accounts payable and accrued wages		$ 691,903	
Students' advance fees and deposits	(A-16)	323,023	
Students' safe-keeping deposits		82,413	
Withholdings, deposits and other credits	(A-17)	847,646	
Advances by U. S. Government for certain research contracts		3,487,746	
Total current liabilities			$ 5,432,731
Gifts and other receipts for current expenses	(A-18)		2,537,046
Investment income unallocated to funds			2,389,974
			$ 10,359,751

Division of Defense Laboratories Liabilities

Accounts payable and accrued wages		$ 631,168
U. S. Government advances		4,800,000
Advanced from Institute funds		432,864
		$ 5,864,032

Educational Plant Capital

Endowment for educational plant	(A-20)	$ 34,417,430
		$113,724,737

SCHEDULE B

SOURCES OF REVENUES AND FUNDS USED TO MEET EXPENSES OF CURRENT OPERATION FOR THE YEAR ENDED JUNE 30, 1954

Sources of Revenues and Funds Used

Tuition and other income	(B-1)	$ 4,486,689
Investment income	(B-2)	1,231,486
Gifts and other receipts	(B-2)	2,775,380
Reimbursement of direct costs of research contracts of Division of Industrial Cooperation (see note)	(B-3)	15,240,251
Contract allowances for administration and plant operation	(B-3)	3,472,119
Auxiliary activities	(B-7)	1,727,254
		$ 28,933,179

Expenses of Current Operation

Academic departments	(B-4)	$ 6,156,684
Direct costs of research contracts of Division of Industrial Cooperation (see note)	(B-3)	15,240,251
Administration and general	(B-5)	3,491,191
Plant operation	(B-6)	2,318,070
Auxiliary activities	(B-7)	1,726,983
		$ 28,933,179

Note: Includes only contracts under supervision of academic departments. Direct costs of contracts of the Division of Defense Laboratories ($17,247,993) are excluded from this statement of the Institute's operations. Costs and revenues under all research contracts are shown on Schedule B-3.

SCHEDULE C

STATEMENT OF FUNDS
FOR THE YEAR ENDED JUNE 30, 1954

	Balance June 30, 1953	*Gifts and Other Receipts*	*Investment Income*	*Transfers In-(Out)*	*Expenses*	*Other Charges*	*Balance, June 30, 1954*
Endowment funds:							
Income for general purposes....(A-3)	$32,444,757	$ 82,558	$ 1,298,390	$ 194,926	$ 1,091,398	.....	$32,929,233
Income for designated purposes....(A-4)	11,206,642	1,231,677	.....*	690,548	.....	$ 238	13,128,629
Student loan funds....(A-5)	2,684,926	38,514	84,477	1,000	.....	30	2,808,887
Building funds....(A-6)	2,033,835	274,400	66,180	202,534	.....	1,166,528	1,410,421
Other expendable funds:							
General purposes....(A-7)	990,279	391,881	47,576	(399,046)	4,597	3,583	1,022,510
Designated purposes....(A-8)	5,256,523	1,996,455	242,567	(660,773)	239,928	373,479	6,221,365
Unexpended endowment income for designated purposes....(A-4)	1,003,432	7,786	527,145	(66,807)	78,351	280,763	1,112,442
Agency and annuity funds....(A-9 and 10)	935,323	58,968	40,436	(44,317)	160	38,200	952,050
General investments — gain and loss account....(A-11)	3,383,874	114,113	.....	.....	.....	.....	3,497,987
Total invested funds....	$59,939,591	$ 4,196,352	$ 2,306,771	$ (81,935)	$ 1,414,434	$ 1,862,821	$63,083,524
Gifts and other receipts for current expenses....(A-18)	2,096,446	3,151,611	.....	81,935	2,592,432	200,514	2,537,046
Investment income unallocated to funds....	1,796,857	.....	593,117	.....	.....	.....	2,389,974
	$63,832,894	$ 7,347,963	$ 2,899,888	.....	$ 4,006,866	$ 2,063,335	$68,010,544

Gifts received during the year	$ 4,642,043	Investment income used...	$ 1,231,486	$ 1,244,302	Buildings
Other receipts (research contract allowances, use of laboratories and services, publications, royalties, gains on sales of securities, and miscellaneous receipts)	2,705,920	Gifts & other receipts used..	2,775,380	479,922	Scholarships & fellowships
	$ 7,347,963		$ 4,006,866	339,111	Other charges to funds not representing operating expenses
				$ 2,063,335	

* Investment Income on endowment funds for designated purposes is included under the caption "Unexpended endowment income for designated purposes."

Auditors' Certificate

To the Auditing Committee of the Massachusetts Institute of Technology:

We have examined the financial statements of Massachusetts Institute of Technology:

Schedule A — Balance Sheet as at June 30, 1954.

Schedule B — Sources of Revenues and Funds Used to Meet Expenses of Current Operation for the Year ended June 30, 1954.

Schedule C — Statement of Funds for the Year ended June 30, 1954.

Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying statements present fairly the financial position of Massachusetts Institute of Technology at June 30, 1954, and the results of its operations for the year then ended.

LYBRAND, ROSS BROS. & MONTGOMERY

Boston, Massachusetts, September 10, 1954

Report of the Auditing Committee

To the Corporation of the Massachusetts Institute of Technology:

The Auditing Committee reports that Lybrand, Ross Bros. & Montgomery were employed to make an audit of the books and accounts of the Institute for the fiscal year ended June 30, 1954 and their certificate is submitted herewith.

Respectfully,

RALPH LOWELL
HAROLD B. RICHMOND

Statement on Accounts

Supporting schedules for the Balance Sheet as of June 30, 1954, and the Sources of Revenues and Funds Used to Meet Expenses of Current Operation are presented in full in the Treasurer's Report issue of the Bulletin. Only those believed to be of more general interest are reprinted on the following pages. Copies of the complete Treasurer's Report may be obtained from the office of the Treasurer, Room 4-110, Massachusetts Institute of Technology, Cambridge 39.

JOHN A. LITTLE

SCHEDULE A-1

GENERAL INVESTMENTS

Par Value	U. S. GOVERNMENT BONDS			*Book Value*	*Net Income*
$ 40,000	U. S. Treasury...	2s	1954	$ 40,000.00	$ 800.00
3,000,000	U. S. Treasury...	2⅜s	1958	2,998,205.57	71,250.00
200,000	U. S. Treasury...	2¾s	1961	200,000.00	.....
3,018,000	U. S. Treasury...	2½s	1961	3,018,399.37	(69.61)
20,000	U. S. Treasury...	2¼s	1962–59	20,187.50	79.12
1,500,000	U. S. Treasury...	2½s	1968–63	1,469,218.75	37,500.00
3,000,000	U. S. Treasury...	2½s	1969–64	3,031,000.00	70,588.12
10,000	U. S. Treasury...	3¼s	1983	10,936.34	46.61
294,000	U. S. Savings "G"	2½s	1954–61	293,894.00	7,350.00
	Income from bonds sold or matured..			.....	99,576.63
	Total U. S. Government bonds.....			$11,081,841.53	$287,120.87
	CANADIAN BONDS				
	Financial				
$ 500,000	Canadian Acceptance Corp., Ltd.....	4½s	1968	$ 510,000.00	$ 8,920.93
500,000	General Motors Acceptance Corp. of Canada.....	4¾s	1969	513,000.00	9,963.47
	Industrial				
200,000	Aluminum Co. of Canada, Ltd...	3⅞s	1970	202,000.00	7,250.00
200,000	Aluminum Co. of Canada, Ltd...	4½s	1973	207,000.00	(2,006.16)
200,000	Interprovincial Pipe Line 1st A.....	3½s	1970	197,375.00	7,105.00
	Public Utility				
200,000	Bell Telephone Co. of Canada.....	4½s	1967	205,000.00	7,790.08
	Total Canadian bonds.....			$ 1,834,375.00	$ 39,023.32
	INDUSTRIAL BONDS				
$1,000,000	General Motors Corp.	3¼s	1979	$ 1,004,800.00	($626.12)
250,000	Phillips Petroleum Co.	3.70s	1983	252,800.00	8,929.48
85,000	Shamrock Oil & Gas Corp.....	3½s	1967	85,200.00	2,775.00
77,000	Standard Oil Co. Ind. convertible deb...	3⅛s	1982	79,085.00	2,084.93
190,000	Southern Production Co. Convertible deb.....	3¾s	1967	186,604.04	5,540.40
	Income from bonds sold.....			.....	4,581.60
	Total industrial bonds.....			$ 1,608,489.04	$ 23,285.29

SCHEDULE A-1 — (Continued)

Par Value				*Book Value*	*Net Income*
	PUBLIC UTILITY BONDS				
$ 200,000	Am. & For. Pr.....	5s	2030	$ 197,182.41	$ 10,000.00
50,000	Am. Gas&Elec. Co...	3⅜s	1977	50,000.00	1,612.50
397,000	Great Lakes Pipe Line deb.....	3¼s	1957	397,425.05	12,526.88
500,000	Great Lakes Pipe Line Co.....	4s	1974	500,000.00	(4,068.06)
200,000	La Gloria Oil & gas Co Sinking Fd deb	5½s	1974	200,000.00	(366.67)
105,000	Northern Natural Gas deb.....	3⅝s	1973	105,900.00	1,578.43
78,000	Puget Sound Pr. Lt.	4¼s	1972	79,100.00	3,135.47
100,000	Southern Natural Gas Co. 1st Pipe Line Sinking Fd.	4s	1973	99,000.00	4,000.00
200,000	Tennessee Gas Transmission Co. 1st Pipe Line...	4⅛s	1973	202,000.00	8,050.00
	Income from bonds sold.....			.....	11,022.61
	Total public utility bonds.....			$ 1,830,607.46	$ 47,491.16
	RAILROAD BONDS				
$ 100,000	Baltimore&Ohio R.R.	4s	1975	$ 86,985.00	$ 4,000.00
50,000	B. & O., P., L.E.& W.Va. 5 yr.	4s	1980	48,643.75	2,000.00
115,000	Northern Pacific R.R.	4s	1997	105,228.29	4,600.00
153,000	Southern Pacific Co.	4½s	1981	150,781.75	6,885.00
	Total railroad bonds.....			$ 391,638.79	$ 17,485.00
	FINANCIAL BONDS				
$ 417,500	Associates Investment Co.....	2⅞s	1955	$ 420,578.43	($ 3,534.25)
500,000	Associates Investment Co.....	2⅞s	1956	503,988.67	(4,232.64)
465,000	Associates Investment Co.....	2⅞s	1957	466,761.09	(3,936.35)
250,000	Com'l Credit Co....	2¾s	1954	250,600.00	1,359.63
250,000	Com'l Credit Co....	2¾s	1955	250,000.00	6,875.00
250,000	Com'l Credit Co....	2¾s	1956	250,000.00	6,875.00
250,000	Com'l Credit Co....	2¾s	1957	250,000.00	6,875.00
500,000	Com'l Credit Co....	3½s	1965	495,000.00	17,500.00
125,000	C.I.T. Financial Corp. Note.....	2¾s	1954	125,250.00	407.08
125,000	C.I.T. Financial Corp. Note.....	2¾s	1955	125,200.00	428.30
500,000	C.I.T. Financial Corp. Note.....	3½s	1959	500,000.00	17,500.00

SCHEDULE A-1 — (*Continued*)

Par Value				*Book Value*	*Net Income*
	FINANCIAL BONDS (*Continued*)				
$1,000,000	Gen. Motors Accept.	4s	1958	$1,000,000.00	$21,780.00
1,000,000	Gen. Motors Accept.	3s	1959	990,000.00	(2,166.67)
1,500,000	Gen. Motors Accept.	3⅞s	1961	1,510,000.00	18,156.36
500,000	Gen. Motors Accept.	3¾s	1965	500,000.00	18,541.67
300,000	International Bank for Reconstruction & Develop...	3s	1976	300,000.00	9,000.00
	Income from bonds sold.....			.....	6,875.00
	Total financial bonds.....			$ 7,937,378.19	$118,303.13
	PREFERRED STOCKS				
Shares					
290	Christiana Sec. Co. $7.00.....			$ 40,520.00	$ 1,767.50
900	Arthur D. Little, Inc. $6.00.....			90,000.00	5,400.00
602	Merck & Company, Incorporated....	4.00.....		64,373.97	2,408.00
	Income from preferred stocks sold....			.....	3,375.00
	Total preferred stocks.....			$ 194,893.97	$ 12,950.50
	INDUSTRIAL COMMON STOCKS				
	Agricultural Equipment				
4,000	International Harvester Company.			$ 53,274.83	$ 8,500.00
	Automobile				
4,275	Chrysler Corporation.....			150,144.60	25,650.00
56,496	General Motors Corporation.....			2,364,318.53	211,184.00
	Building Supplies				
7,000	Johns-Manville Corporation.....			256,304.86	26,250.00
12,604	National Lead Company.....			118,223.14	23,947.60
7,000	Pittsburgh Plate Glass Company..			138,602.46	13,500.00
2,000	Sherwin Williams Company.....			100,988.10	8,000.00
	Chemicals and Drugs				
4,008	Allied Chemical & Dye Corporation			169,777.26	12,625.20
1,000	American Cyanamid Company....			50,704.09	2,000.00
268	Christiana Securities Company....			729,174.35	81,204.00
5,268	Dow Chemical Company.....			102,412.70	5,204.00
1,893	E.I. du Pont deNemours & Company			162,367.12	7,460.15
30,279 80/100	Eastman Kodak Company.....			382,066.02	57,530.10
10,000	Hercules Powder Company.....			492,799.94	30,000.00
18,060	Merck & Co., Inc.....			108,717.47	14,448.00
4,100	Monsanto Chemical Company.....			96,803.58	10,250.00
14,002	Union Carbide&Carbon Corporation			288,770.85	35,005.00
	Containers				
16,057	American Can Company.....			437,342.37	19,539.80
6,070	Owens-Illinois Glass Company....			348,022.10	24,280.00

SCHEDULE A-1 — (Continued)

Shares		*Book Value*	*Net Income*
	INDUSTRIAL COMMON STOCKS — (*Continued*)		
	Electrical Equipment		
16,065	Thomas A. Edison, Inc.	$ 180,000.00	$ 19,089.00
27,609	General Electric Company	248,334.97	41,389.50
3,200	General Radio Company	73,850.00	.....
6,000	Westinghouse Electric Corporation	107,827.11	12,000.00
	Food and Beverages		
3,150	Liquid Carbonic Corporation	53,551.11	4,410.00
8,306	United Fruit Company	136,700.86	29,071.00
	Machinery		
4,160	Caterpillar Tractor Company	92,194.13	8,240.00
6,000	Draper Corporation	96,132.10	8,400.00
6,000	United Shoe Machinery Corp.	352,340.53	15,000.00
	Non-Ferrous Metal		
4,000	International Nickel Company	134,488.60	9,400.00
3,943	Kennecott Copper Corporation	245,819.30	23,658.00
	Office Equipment		
1,575	International Business Machines Corporation	49,997.96	5,293.00
3,498	National Cash Register Company.	96,166.04	10,017.00
	Oil		
7,572	Gulf Oil Corporation	184,931.62	14,852.00
16,000	Humble Oil & Refining Company	339,294.10	36,480.00
5,000	Ohio Oil Company	188,137.25	13,625.00
6,166	Phillips Petroleum Company	176,741.40	16,031.60
16,335	Socony Vacuum Oil Co., Inc.	303,159.00	36,753.75
11,350	Standard Oil Company of California	343,751.66	34,050.00
7,115	Standard Oil Company (Indiana).	288,059.45	27,451.37
19,304	Standard Oil Company (N.J.).	493,630.92	89,621.60
5,075	Texas Company	162,250.32	15,759.70
	Paper		
11,009	International Paper Company	180,496.21	32,276.10
	Retail Trade		
4,023	Montgomery Ward & Company	262,623.32	14,069.00
5,000	J. C. Penney Company	154,666.05	17,500.00
7,108	Sears, Roebuck & Company	170,284.79	16,668.80
	Soap		
7,500	Procter & Gamble Company	261,143.86	24,375.00
	Steel		
6,000	Inland Steel Company	198,474.49	21,000.00
6,600	National Steel Corporation	149,488.34	21,450.00

SCHEDULE A-1 — (Continued)

Shares		*Book Value*	*Net Income*
	INDUSTRIAL COMMON STOCKS *Continued*		
	Tobacco		
1,500	American Tobacco Company.....	$ 108,571.31	$ 6,300.00
1,500	Liggett & Myers Tobacco Company	104,917.80	7,500.00
	Miscellaneous		
2,500	Consolidated Rendering Company.	169,500.00	10,000.00
5,216	Minnesota Mining&Mfg. Company	142,468.00	5,077.60
	Income on stocks sold.....	.....	17,431.30
	Total industrial common stocks...	$12,800,806.97	$1,280,818.17
	PUBLIC UTILITY COMMON STOCKS		
17,952	American Gas & Electric Company	$ 340,850.07	$ 29,441.28
1,101	American Tel. & Tel. Company...	137,820.69	9,724.50
4,240	Boston Edison Company.....	155,396.99	11,872.00
8,185	Commonwealth Edison Company.	231,959.27	14,733.00
6,400	General Public Utilities Corp.....	182,475.34	4,142.50
3,500	Illinois Power Company.....	127,251.83	7,700.00
9,400	Middle South Utilities.....	258,613.60	5,390.00
3,900	Montana Power Company.....	129,878.86	1,560.00
4,000	Southern California Edison Co.....	141,089.14	8,000.00
2,100	Southern Company.....	31,895.00	840.00
6,120	Texas Gas Transmission Company.	102,750.00	6,060.00
17,831	Virginia Electric & Power Company	407,379.06	19,363.40
	Total public utility common stocks	$ 2,247,359.85	$ 118,826.68
	RAILROAD COMMON STOCKS		
4,130	Atchison, Topeka&Santa Fe R'wy.	$ 188,798.69	$ 28,910.00
2,030	Great Northern Railway Co. Pfd...	97,504.63	8,120.00
1,000	Northern Pacific Railway Company	61,696.95	3,000.00
	Total railroad common stocks.....	$ 348,000.27	$ 40,030.00
	BANK STOCKS		
3,750	Bankers Trust Company,New York	$ 189,613.75	$ 8,250.00
3,031	Cont. Ill. Nat. Bank, Chicago.....	174,542.92	12,124.00
5,370	The First National Bank, Boston..	298,516.42	12,504.00
5,875	Guaranty Trust Co. of New York	329,999.04	20,562.50
2,570	The Hanover Bank, New York...	233,527.11	9,425.00
1,000	Harris Trust & Savings, Chicago..	146,522.00	12,000.00
7,189	National City Bank, New York...	297,620.40	15,096.90
	Total bank stocks.....	$ 1,670,341.64	$ 89,962.40

SCHEDULE A-1—Continued

Shares		*Book Value*	*Net Income*
	INSURANCE STOCKS		
8,334	Boston Insurance Company	$ 197,914.51	$ 11,667.60
2,125	Continental Ins. Co., New York	68,383.05	6,693.75
8,652	Fireman's Fund Ins. Co., Calif.	209,379.20	12,533.40
2,885	Hartford Fire Ins. Co., Conn.	112,547.69	6,924.00
7,680	Insurance Co. of North America	161,635.55	17,600.00
	Total insurance stocks	$ 749,860.00	$55,418.75
	OTHER STOCKS		
6,000	American Research & Development Corporation	$ 148,500.00	.....
10,250	Bond Investment Trust of America	200,084.00	$ 9,225.00
12,177	Century Shares Trust	200,024.22	5,798.94
360	Cochran Foil Company	6,680.00	522.00
27,536	Colonial Fund, Inc.	222,139.36	17,348.10
446	The Dewey and Almy Chemical Company	11,748.00	401.40
675	Photon, Incorporated	9,690.63	.....
500	Rockwell Manufacturing Company	10,000.00	1,000.00
735	J. P. Stevens and Company, Inc.	25,325.00	1,470.00
1,000	Stone and Webster, Inc.	29,507.65	2,000.00
	Investment in 20 other securities	54,610.02	2,297.30
	Income from securities sold	.....	641.28
	Total other stocks	$ 918,308.88	$ 40,704.02
	MORTGAGE NOTES		
	Common Street, Belmont	$ 5,015.00	$ 303.20
	Bay State Road, Boston	9,250.00	368.75
	Coliincote Street, Stoneham	500.00	20.00
	Maude Terrace, Watertown	1,868.07	90.09
	Mt. Auburn Street, Watertown	26,083.49	1,198.14
	Park Avenue, Arlington	6,746.37	317.11
	Ruby Avenue, Marblehead	5,100.00	240.76
	Summer Street, Watertown	4,614.06	366.10
	Alpha Tau Omega	7,100.00	400.00
	Beta Theta Pi	14,000.00	737.50
	Delta Kappa Epsilon	8,000.00	488.87
	Kappa Sigma	9,000.00	562.50
	Lambda Chi Alpha	10,223.38	542.47
	Pi Lambda Phi	3,000.00	187.50
	Phi Kappa	12,575.00	669.38
	Phi Mu Delta	3,000.00	250.00
	Sigma Chi	3,500.00	131.25
	Income on paid up mortgages		383.99
	Total mortgage notes	$ 129,575.37	$ 7,257.61

SCHEDULE A-1 — (Continued)

	Book Value	*Net Income*
REAL ESTATE DEVOTED TO INSTITUTE USE		
Dormitories and Housing		
120 Bay State Road, Boston	$ 27,000.00	$ 700.00
Graduate House	647,951.94	2,636.38
Baker House	2,064,180.53	.....
Burton House	1,438,167.87*	.....
Westgate Veterans' Housing	459,492.60	10,685.59
Total dormitories and housing	$ 4,636,792.94	$ 14,021.97
Research		
565 Memorial Drive, Cambridge	200,560.50	10,529.00
209 Mass. Ave., Cambridge	100,000.00	5,250.00
Wood Street, Lexington, Mass.	67,424.04	3,540.00
68–92 Albany Street, Cambridge	125,000.00	7,875.00
Total for research	$ 492,984.54	$ 27,194.00
OTHER REAL ESTATE		
36–44 Memorial Drive, Cambridge	$ 1,298,599.71	$ 61,140.18
80 Memorial Drive, Cambridge	874,915.93	43,648.93
100 Memorial Drive, Cambridge	153,510.85	6,399.96
333 Memorial Drive, Cambridge	40,000.00	.....
500 Memorial Drive, Cambridge (Building and Fixtures)	77,713.98	3,102.92
540–550 Memorial Drive, Cambridge (Land)	351,524.51	14,751.11
640 Memorial Drive, Cambridge	9,211.94	.....
Gloversville, N. Y.	220,994.30	11,084.07
New London, Conn.	220,825.72	10,506.05
Plattsburg, N. Y.	160,121.28	7,386.19
Taunton, Mass.	180,560.11	8,228.75
Waltham, Mass.	636,519.55	31,905.27
Willimantic, Conn.	147,990.23	6,690.19
Main Street, Worcester, Mass.	178,830.73	8,148.84
Federal Street, Worcester, Mass.	342,662.65	16,604.26
Bexley Hall, Cambridge	135,280.61	7,749.63
76–94 Mass. Ave., Cambridge	428,678.74	7,085.76
121–167 Vassar Street, Cambridge	135,000.00	.....
Income on property sold		11,511.94
Total other real estate	$ 5,592,940.84	$ 255,944.05

*Not including first mortgage of $368,097.38.

SCHEDULE A-1—(Continued)

Par Value		*Book Value*	*Net Income*
	COMMERCIAL PAPER		
$1,000,000	Associates Investment Company (Indiana).....1954	$ 986,875.00	.....
325,000	General Electric Supply Company.....1954	323,327.61	.....
200,000	General Electric Supply Company.....1954	199,197.92	.....
500,000	General Electric Supply Company.....1954	497,689.24	.....
1,000,000	General Motors Acceptance Corp.....1954	991,739.58	.....
500,000	Industrial Acceptance Corp.....1954	493,801.37	.....
	Income from maturities.....		$ 143,271.57
	Total commercial paper.....	$ 3,492,630.72	$ 143,271.57
	Advances for current operations..	$ (273,903.01)	$ 62,120.00
	Total general investments.....	$57,684,922.99	$2,681,228.49
		(Schedule A)	

SCHEDULE A-2

INVESTMENTS OF FUNDS SEPARATELY INVESTED

Par Value or Shares		*Book Value*	*Net Income*
	AVOCA FUND		
3,600	General Radio Company	$ 76,200.00	.....
	BABSON FUND		
$2,000	U. S. Treasury..... 2s 1954	$ 1,995.63	$ 40.00
2,000	U. S. Treasury..... 2¼s 1956–59	2,000.00	45.00
1,000	U. S. Savings "G" .. 2½s 1961	1,000.00	25.00
1,000	U. S. Savings "G" .. 2½s 1963	1,000.00	25.00
80	United Stores, Corp. $6 Cum. Conv. Pfd,	8,034.54	480.00
80	United Stores, Corp. $4.20 Pfd.....	1,284.62	64.00
20	E. I. du Pont de Nemours & Co.....	1,722.86	82.00
30	Standard Oil Co. (Indiana).....	1,413.36	119.06
	Total Babson Fund.....	$ 18,451.01	$ 880.06
	MALCOLM COTTON BROWN FUND		
$1,000	U. S. Savings "G".. 2½s 1961	$ 1,000.00	$ 25.00
1,000	U. S. Savings "K".. 2.76 1966	1,000.00	.....
90	General Electric Company.....	1,019.70	135.00
10	Union Carbide & Carbon Corporation.	745.00	5.00
	Income from bonds sold.....	.....	62.50
	Total Brown Fund.....	$ 3,764.70	$ 227.50
	CLASS OF 1919 FUND		
$4,650	U. S. Savings "F".....1955–57	$ 3,441.00	.....
	RICHARD LEE RUSSEL FUND		
$4,100	Mortgage Note, Spear and Wibird Sts. Quincy.....	$ 4,100.00	$ 142.34
1,000	Mortgage Note (participation).....	1,000.00	50.00
	Total Russel Fund.....	$ 5,100.00	$ 192.34
	SOLAR ENERGY FUND		
$20,000	U. S. Treasury Note, Series A..... 1½s 1955	$ 19,725.00	$ 300.00
50,000	U.S.A. Cert. of Indebt. E...2⅝s 1954	50,000.00	.....
5,000	Godfrey L. Cabot, Inc.....	647,700.00	40,000.00
1,950	General Electric Company.....	32,468.22	2,505.00
324	Mission Corporation.....	6,291.00	.....
	Income from bonds sold.....	.....	500.00
	Total Solar Energy Fund.....	$ 756,184.22	$43,305.00

SCHEDULE A-2 — (*Continued*)

Par Value or Shares				*Book Value*	*Net Income*
	RESEARCH FUND, SCHOOL OF INDUSTRIAL MANAGEMENT				
$85,0000	Commercial Investment Trust, Inc. 1954			$ 84,260.38	.....
20,000	General Motors Corporation			1,000,000.00	$80,000.00
	Income from notes sold			.....	1,042.71
	Total Research Fund, S. I. M.			$1,084,260.38	$81,042.71
	JONATHAN WHITNEY FUND				
$281,000	U. S. Savings "G"	2½s	1954–58	$ 281,000.00	$ 7,025.00
40,000	General Motors Acceptance Corp. of Canada	4¾s	1969	41,300.00	261.96
40,000	Niagara Mohawk Pr.	2⅞s	1980	40,000.00	1,150.00
40,000	Pacific Gas & Elec. Co.	3s	1974	40,000.00	900.00
410	Bankers Trust Co., N. Y.			18,937.50	902.00
200	Boston Edison Company			7,405.22	560.00
748	Boston Insurance Company			19,145.78	1,047.20
300	Chrysler Corporation			16,594.85	1,800.00
400	E. I. du Pont de Nemours & Co.			15,279.10	1,640.00
270	First National Bank of Boston			11,465.90	628.00
1,500	General Electric Company			13,188.05	2,250.00
330	Guaranty Trust Co. of N. Y.			18,087.30	1,155.00
400	Inland Steel Company			16,120.12	1,400.00
825	International Paper Company			14,642.60	2,418.75
468	National City Bank, N. Y.			20,752.45	982.80
644	Standard Oil Co. (New Jersey)			12,311.87	2,994.60
450	United Fruit Company			10,690.25	1,575.00
	Income from bonds sold			.....	1,250.00
	Total Whitney Fund			$ 596,920.99	$29,940.31
	CLASS OF 1920 FUND				
$3,150	U. S. Savings "F"		1957	$ 2,331.00	.....
2,175	U. S. Savings "F"		1958	1,609.50	.....
	Total Class 1920 Fund			$ 3,940.50	.....
	DRAPER FUND				
$ 24,000	U. S. Savings "G"	2½s	1955	$ 24,000.00	$ 600.00
10,000	U. S. Savings "G"	2½s	1959	10,000.00	250.00
21,000	U. S. Savings "G"	2½s	1960	21,000.00	525.00
5,000	Baltimore & Ohio R.R.	4s	1975	5,000.00	200.00
5,000	Northern Pacific R.R.	4s	1997	4,598.31	200.00
5,000	Southern Pacific Co.	4½s	1981	5,000.00	225.00
30,000	General Motors Acceptance Corp. of Canada	4¾s	1969	30,800.00	329.43
100	E. I. du Pont de Nemours & Co.			4,731.05	410.00
60	Standard Oil Co. (New Jersey)			2,010.78	279.00
	Income from bonds sold			.....	747.50
	Total Draper Fund			$ 107,140.14	$3,765.93

SCHEDULE A-2 — (Continued)

Par Value				*Book Value*	*Net Income*
	TECHNOLOGY LOAN FUND				
$ 50,000	U. S. A. Cert. of Indebt. E	2⅝s	1954	$ 50,000.00	.....
550,000	U. S. Savings "G".	2½s	1954–60	550,000.00	$ 13,75000
96,000	U. S. Treasury.....	2¼s	1962–59	96,000.00	2,160.00
35,000	Am. Tel.&Tel.Co...	2¾s	1980	35,000.00	962.50
15,000	Pacific Gas & Elec. Co.	3s	1974	15,000.00	450.00
1,980	American Can Company.....			40,814.83	2,772.00
2,000	Burroughs Corporation.....			39,830.94	.....
800	E. I. du Pont de Nemours & Co.....			29,304.00	3,280.00
3,000	General Electric Company.....			25,813.25	4,500.00
885	Guaranty Trust Company of N. Y...			50,333.82	3,097.50
1,352	Gulf Oil Corporation.....			32,630.80	2,652.00
668	Hartford Fire Insurance Co., Conn...			44,879.08	1,602.00
500	Monsanto Chemical Company.....			46,346.30	.....
1,331	National Cash Register Company....			38,458.96	3,811.50
1,302	National City Bank, N. Y.....			46,537.04	2,734.20
1,000	Pittsburgh Plate Glass Company....			53,780.85	.....
2,250	Public Service of Indiana.....			62,493.34	4,387.50
750	Procter & Gamble Company.....			29,511.45	2,437.50
280	St. Paul Fire & Marine Ins. Company.			6,737.50	280.00
1,000	Socony Vacuum Oil Company.....			44,156.46	.....
1,286	Standard Oil Company (New Jersey)..			24,864.43	5,979.90
1,200	Union Carbide and Carbon Corp.....			27,726.00	3,000.00
900	United Fruit Company.....			21,360.20	3,150.00
	Income from bonds and stocks sold..				8,802.31
	Total Technology Loan Fund.....			$1,411,579.25	$ 69,808.91
	JOSEPH HEWETT FUND				
$11,000	U. S. Treasury.....	2¼s	1959–62	$ 10,893.44	$ 247.50
17,000	U. S. Savings "G"..	2½s	1958–61	17,000.00	425.00
15,000	Alabama Power Co.	3⅛s	1972	15,000.00	525.00
4,000	Puget Sound Pr. & Lt.	4¼s	1972	4,000.00	170.00
12,000	Baltimore & Ohio R.R.	4s	1975	12,000.00	480.00
10,000	Northern Pacific R.R.	4s	1997	10,200.00	300.00
10,000	Southern Pacific Co.	4½s	1981	10,100.00	400.00
12,000	Texas & New Orleans R.R.....	3⅜s	1990	12,000.00	405.00
50,000	General Motors Accept. Corp. of Canada	4¾s	1969	51,300.00	443.43
440	American Can Company.....			8,570.00	616.00
120	Bankers Trust Company (N. Y.)....			4,775.00	264.00
200	E. I. du Pont de Nemours & Company			8,271.55	820.00
900	General Electric Company.....			8,107.50	1,350.00
110	Guaranty Trust Co. N. Y.....			5,078.70	385.00
200	National Cash Register Company...			5,461.53	570.75
200	St. Paul Fire & Marine Insurance Co..			4,812.50	200.00
200	Standard Oil Company (Indiana)....			9,392.40	772.75
451	Standard Oil Company (New Jersey).			9,444.88	2,093.15
300	Union Carbide and Carbon Corp.....			6,944.20	750.00
300	United Fruit Company.....			7,120.00	1,050.00
	Income from bonds sold.....				1,250.00
	Total Hewett Fund.....			$ 220,471.70	$ 13,517.58

SCHEDULE A-2 — (Continued)

Par Value or Shares				*Book Value*	*Net Income*
	GEORGE S. WITMER FUND				
$ 12,800	U. S. Savings "G"..	2½s	1954–61	$ 12,800.00	$ 320.00
5,000	Am. Tel. & Tel. Co..	2¾s	1971	4,949.55	137.50
5,000	Northern Pacific R.R.	4s	1997	4,903.79	200.00
4,000	Southern Pacific Co.	4½s	1981	3,942.68	180.00
5,000	General Motors Accept. Corp. of Canada.....	4¾s	1969	5,200.00	(74.22)
75	The Denver & Rio Grande Western R.R. Co.....			4,500.00	387.50
100	C. I. T. Financial Corp.....			3,300.00	.....
150	Commonwealth Edison Company....			5,046.50	270.00
220	Middle South Utilities.....			1,733.58	308.00
180	Pacific Gas & Electric Company.....			6,675.34	374.40
300	United Gas Corporation.....			2,125.01	373.43
120	St. Paul Fire & Marine Insurance Co..			2,887.50	120.00
210	General Electric Company.....			3,235.75	285.00
90	General Motors Corporation.....			2,503.46	360.00
102	Hershey Chocolate Corporation.....			4,000.00	255.00
100	Minneapolis Honeywell Regulator Company.....			5,494.69	235.00
100	R. J. Reynolds Tobacco Company...			4,200.00	220.00
100	The Sperry Corporation.....			2,500.00	300.00
43	Standard Oil Company (Indiana)....			1,944.86	170.68
100	Standard Oil Company (New Jersey)			2,684.08	452.00
100	Union Carbide and Carbon Corp.....			2,713.10	245.00
65	Bankers Trust Co. (N. Y.).....			3,071.50	143.00
110	Guaranty Trust Co. of N.Y.....			5,920.20	385.00
	Real estate, Sanford, Fla.....			3,145.19	206.33
	Income from bonds sold.....				125.00
	Total Witmer Fund.....			$ 99,476.78	$ 5,978.62
Total funds separately invested.....				$4,386,930.67	$248,658.96
				(Schedule A)	

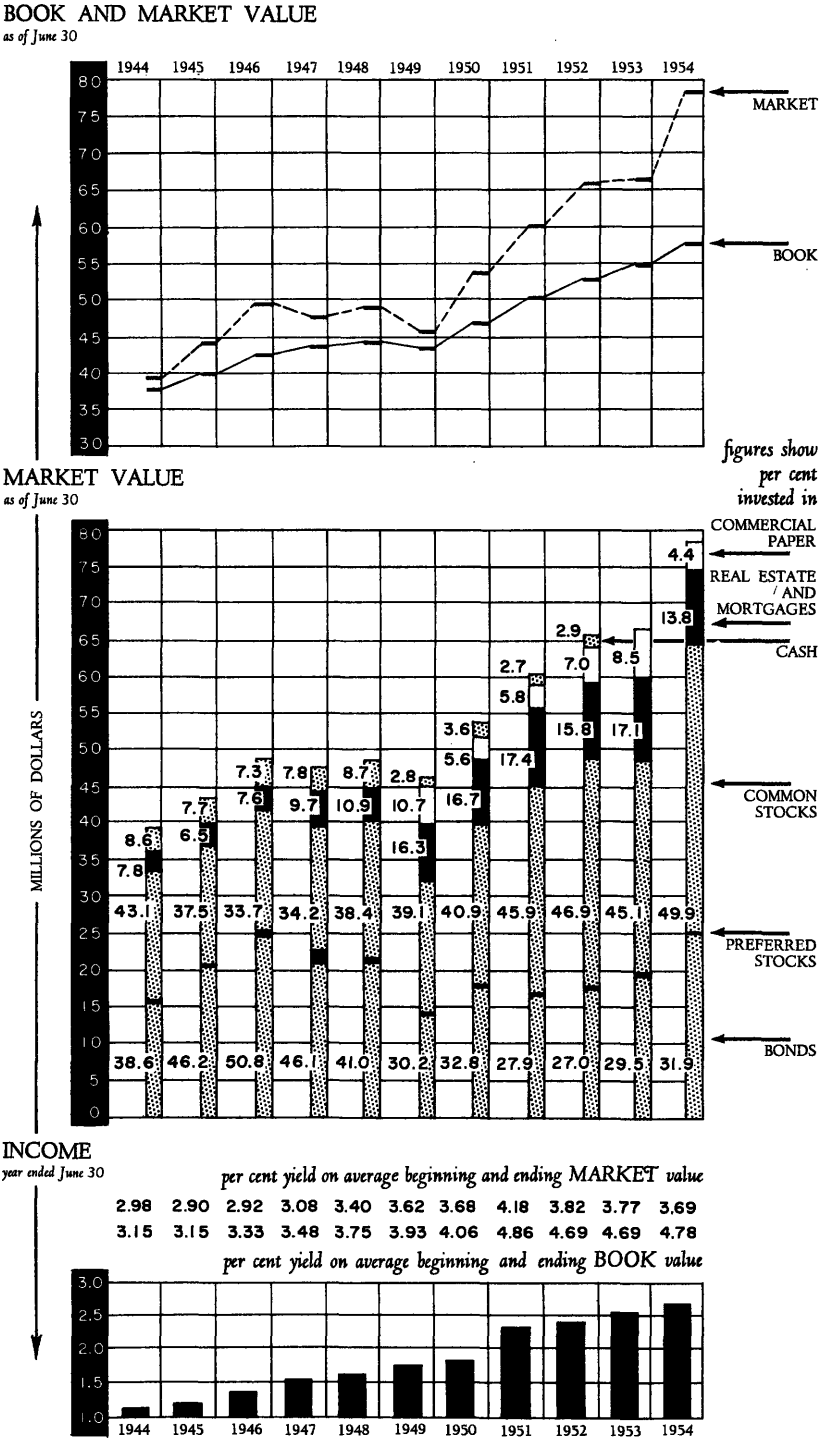
INVESTMENTS — SUMMARY

JUNE 30, 1954

General Investments	*Book Value*	*Market Value*	*Per Cent*	*Net Income*	*Per Cent*
Bonds					
U. S. Government	$11,081,842	$11,263,188	14.3	$ 287,121	10.7
Canadian	1,834,375	1,890,280	2.4	39,023	1.5
Industrial	1,608,489	1,675,972	2.1	23,285	.9
Public Utility	1,830,607	1,819,095	2.3	47,491	1.8
Railroad	391,639	436,855	.6	17,485	.7
Financial	7,937,378	8,036,620	10.2	118,303	4.4
Total	$24,684,330	$25,122,010	31.9	$ 532,708	20.0
Preferred Stocks	$ 194,894	$186,656	.3	$ 12,951	.5
Common Stocks					
Industrial	$12,800,807	$29,973,719	38.1	$1,280,818	47.8
Public Utility	2,247,360	3,068,093	3.9	118,827	4.4
Railroad	348,000	629,387	.8	40,030	1.5
Bank	1,670,342	2,140,094	2.7	89,962	3.3
Insurance	749,860	2,280,268	2.9	55,419	2.1
Other	918,309	1,133,152	1.5	40,704	1.5
Total	$18,734,678	$39,224,713	49.9	$1,625,760	60.6
Mortgage Notes	$ 129,575	$ 129,575	.2	$ 7,258	.3
Real Estate					
For Institute Use	$ 5,129,777	$ 5,129,777	6.5	$ 41,216	1.5
Other Property	5,592,941	5,592,941	7.1	255,944	9.5
Total	$10,722,718	$10,722,718	13.6	$ 297,160	11.0
Commercial Paper	$ 3,492,631	$ 3,492,631	4.4	$ 143,272	5.3
Advanced for Current Operations	$ (273,903)	$ (273,903)	(.3)	$ 62,120	2.3
Total General Investments	$57,684,923	$78,604,400	100.0	$2,681,229	100.0
Special Investments	$ 4,386,931	$ 6,031,949		$ 248,659	
Students' Notes Receivable	$ 1,011,670	$ 1,011,670		*	
Charge for financial services				$ (30,000)	
Total Investments	$63,083,524	$85,648,019		$2,899,888	

* Interest credited directly to student loan funds.

General Investments 1944-1954



RESEARCH CONTRACTS

	Division of Industrial Cooperation		Division of Defense Laboratories	
Revenues from research contracts		$18,054,555*		$19,180,114
Less appropriations therefrom:				
Reserve for use of facilities	$ 439,145		$ 218,786	
Industrial fund	115,229		221,058	
Investment income for use of funds and amortization of facilities	114,314		.....	
Research reserve	100,000		100,000	
Other	(34,226)	734,462	.....	539,844
		$17,320,093		$18,640,270
Direct expenses on research contracts:				
Salaries and wages	$10,409,096		$ 7,631,433	
Materials and services	3,141,803		5,913,344*	
Subcontracts	491,555		2,565,060	
Travel	387,110		317,239	
Other	161,019		438,670	
	$14,590,583		$16,865,746	
Direct expenses of the Divisions:				
Salaries and wages	$ 273,637		$ 208,605	
Materials and services	54,802		19,145	
Travel	10,134		6,462	
Vacation allowances — hourly employees	140,000		107,000	
Depreciation on equipment	38,212		6,793	
Insurance	39,427		9,871	
Outside rentals	2,291		.....	
Instrumentation laboratory — expenses	17,448		.....	
Servomechanisms laboratory — expenses	18,018		.....	
Occupational medical service	35,454		10,700	
Unallowable contract expense	13,766		3,001	
Other	6,479		10,670	
	$ 649,668		$ 382,247	
Total expenses (Schedule B)		$15,240,251		$17,247,993
Contract allowances for expenses of administration and plant operation (total $3,472,119 Schedule B)	.....	$ 2,079,842	.....	$ 1,392,277

* Includes $298,901 charge for work performed by Division of Industrial Cooperation for the Division of Defense Laboratories.

GIFTS, GRANTS AND BEQUESTS RECEIVED DURING THE YEAR ENDED JUNE 30, 1954

GIFTS FOR ENDOWMENT

The income of the following gifts and bequests is for general purposes:

CLASS OF 1909		
Contributions	$	211.46
CLASS OF 1928		
Contributions		1,010.00
MARY ELIZABETH LADD		
For Charles C. Ladd ('30) Fund		100.00
GORDON K. LISTER ('30)		
For Charles C. Ladd ('30) Fund		250.00
CHARLES T. MAIN INC.		
Charles T. ('76) and Charles R. ('09) Main Memorial Fund		500.00
ESTATE OF HARRIETTE A. NEVINS		
Additional for George Blackburn Memorial Fund		359.71
ESTATE OF EVERETT WESTCOTT		
Additional for Everett Westcott Fund		800.00
ESTATE OF MARION WESTCOTT		
Additional for Marion Westcott Fund		79,327.11
	$	82,558.28

The income of the following gifts and bequests is for designated purposes:

ANONYMOUS		
For Jerome C. Hunsaker ('12) Professorship	$	5,000.00
ANONYMOUS		
For Anonymous W.		4,275.00
JULIAN M. AVERY ('18)		
For Julian M. Avery Fund		3,289.27
ESTATE OF JASON S. BAILEY		
For Jason S. Bailey Fund		11,510.28
EVERETT M. BAKER MEMORIAL FUND		
Contributions		43.00
ESTATE OF BERTRAM BREWER		
For Bertram Brewer Fund		8,000.00
GODFREY L. CABOT ('81)		
For Godfrey L. Cabot Scholarship		5,000.00
DONALD F. CARPENTER '22		
For Allan Winter Rowe ('01) Fund		50.00
LOUIS S. CATES '02		
For Allan Winter Rowe ('01) Fund		500.00
CHRIST CELLA RESTAURANTS		
For Allan Winter Rowe ('01) Fund		500.00
SAMUEL H. COHEN '24		
For Karl T. Compton Prize Fund		50.00
CONSOLIDATED VULTEE AIRCRAFT COMPANY		
For Jerome C. Hunsaker ('12) Professorship		25,000.00
GEORGE T. COTTLE '98		
For Allan Winter Rowe ('01) Fund		2,000.00
ESTATE OF EUNICE MCLELLAN CRUFT		
For scholarship		17.65

DOELCAM CORPORATION	
For scholarship	$ 10,000.00
W. W. DRUMMEY '16	
For general undergraduate scholarship	100.00
HENRY B. DUPONT '23	
For Allan Winter Rowe ('01) Fund	3,184.13
PIERRE S. DUPONT '90	
For Allan Winter Rowe ('01) Fund	7,281.25
GEORGE P. EDMONDS '26	
For Allan Winter Rowe ('01) Fund	500.00
ELECTRIC REGULATOR CORPORATION	
For Electric Regulator Corporation Fellowship	1,000.00
A. B. ERICKSON	
For Allan Winter Rowe ('01) Fund	500.00
HORACE S. FORD	
For Allan Winter Rowe ('01) Fund	500.00
GOODYEAR TIRE AND RUBBER COMPANY	
For Jerome C. Hunsaker ('12) Professorship	25,000.00
ESTATE OF KATIE M. A. GRIMMONS	
For John A. Grimmons ('21) Scholarship Fund	3,106.55
GRUMMAN AIRCRAFT ENGINEERING COMPANY	
For Jerome C. Hunsaker ('12) Professorship	25,000.00
GUGGENHEIM FOUNDATION	
For Jerome C. Hunsaker ('12) Professorship	25,000.00
LEON HYZEN '33	
For William Emerson Fund	100.00
INSTITUTE OF AERONAUTICAL SCIENCES(GLENN L. MARTIN)	
For Jerome C. Hunsaker ('12) Professorship	50,000.00
DUGALD C. JACKSON, JR. '21	
Additional for Dugald Caleb Jackson Professorship	40.00
IRVING D. JAKOBSON '21	
For Allan Winter Rowe ('01) Fund	125.00
KRESGE FOUNDATION	
For Kresge Foundation Fund	250,000.00
MACHLETT LABORATORIES, INCORPORATED	
For Machlett Fund	40,000.00
FRANCESCO MARCUCELLA '27	
For scholarships	1,000.00
H. W. MCCURDY '22	
For Allan Winter Rowe ('01) Fund	500.00
ESTATE OF ALEXANDER G. MERCER	
For Hall-Mercer Fund	431.56
MORNINGSTAR CORPORATION	
For scholarship	8,000.00
MRS. ODETTE S. PRICE	
For Raymond B. Price ('94) Memorial Fund	1,000.00
GEORGE C. PUTNAM '36	
For James R. Putnam ('01) Fund	1,000.00
F. P. SCULLY '15	
For Allan Winter Rowe ('01) Fund	100.00
H. N. SLATER	
For Jerome C. Hunsaker ('12) Professorship	1,000.00

TRAILMOBILE TRUST FUND	
For Martin Aircraft Scholarship	$ 25,000.00
UNITED AIRCRAFT CORPORATION	
For Jerome C. Hunsaker ('12) Professorship	12,000.00
UNITED AIRLINES FOUNDATION	
For Jerome C. Hunsaker ('12) Professorship	500.00
EDWIN S. WEBSTER ('88) FOUNDATION	
For Edwin S. Webster Professorship	100,000.00
ALBERT H. WECHSLER '21	
For Karl T. Compton Prize Fund	950.00
WHITEHEAD AND KALES	
For William R. Kales ('92) Fund	10,000.00
ESTATE OF EDITH CARSON WILDER	
For Stephen H. Wilder ('74) Fund for Research	8,526.22
HENRY E. WORCESTER '97	
For Allan Winter Rowe ('01) Fund	500.00
Other gifts	49.57
	$677,229.48

GIFTS FOR STUDENT LOANS

RICHARD C. KOHL '49	
For Technology Loan Fund	$ 9.32

GIFTS FOR BUILDINGS

THOMAS C. DESMOND '09	
For Physical Science Building Fund	$ 5,000.00
DEWEY AND ALMY CHEMICAL COMPANY	
For Auditorium Organ Fund	250.00
EASTMAN KODAK COMPANY	
For Auditorium Organ Fund	1,000.00
BARNETT D. GORDON	
For Auditorium Organ Fund	100.00
W. C. HAMILTON AND SONS	
For Auditorium Organ Fund	500.00
RALPH HART '15	
For Auditorium Organ Fund	1,000.00
E. HENDERSON '21	
For Auditorium Organ Fund	100.00
HODGMAN RUBBER COMPANY	
For Auditorium Organ Fund in memory of M. B. Kaufman	250.00
ELMER C. INGRAHAM '26	
For Research Laboratory of Electronics Building Fund	100.00
KRESGE FOUNDATION	
For Kresge Building Fund	250,000.00
LENNOX FURNACE COMPANY	
For Auditorium Organ Fund	1,000.00
METALS CONTROLS CORPORATION	
For Auditorium Organ Fund	1,000.00
ROBERT L. MOORE '21	
For Auditorium Organ Fund	100.00

National Biscuit Company		
For Auditorium Organ Fund	$	1,000.00
Morehead Patterson		
For Physical Science Building		5,000.00
Redfield Proctor '02		
For Faculty Club		7,000.00
United Carr Fastener Corporation		
For Auditorium Organ Fund		1,000.00
	$	274,400.00

OTHER GIFTS — PRINCIPAL AVAILABLE

The following gifts are added to the unexpended endowment income for designated purposes:

Anonymous		
For current use of Lester D. Gardner ('98) Scholarship	$	1,000.00
Charles Hayden ('90) Foundation		
For Charles Hayden Memorial Special		5,000.00
M. I. T. Club of Chicago		
For current use as scholarships		1,086.33
Trailmobile Trust Fund		
For Martin Aircraft Scholarship		700.00
	$	7,786.33

The following gifts are for general purposes:

Anonymous		
Additional for Anonymous J	$	500.00
Anonymous		
For Anonymous ST		2,500.00
Estate of Birney C. Batcheller '86		
Additional distribution under a residuary bequest		16,643.99
Class gifts		
Additional contributions to class funds		639.50
Karl T. Compton Memorial Fund		
Contributions		125.00
Estate of Arthur J. Conner '88		
Residuary interest in a trust created by will		4,941.21
Development Fund		
Contributions for undesignated purposes received during the current year under the Development Program		94,736.23
Estate of Edward C. Hall '92		
Bequest for general purposes		165,977.68
William T. Henry ('70) Trust		
Income of a trust		24,625.00
Abby W. Hunt		
For Abby W. Hunt Fund		1,930.00
Lockheed Aircraft Company		
For Lockheed Leadership Fund		5,000.00
M. I. T. Little Trust		
Rental income and sale of machinery		10,905.84

ESTATE OF ALICE METCALF	
For Leonard Metcalf ('92) Fund	$ 2,772.79
E. MORTIMER NEWLIN ('14) TRUST	
Income of a trust	1,343.00
RICHARD N. PALMER ('28) TRUST	
For general purposes	334.14
ESTATE OF EDWARD A. SUMNER '97	
Additional distribution of a residuary bequest	1.06
ESTATE OF H. SYLVIA A. H. G. WILKS	
Additional distribution of a bequest	58,905.09
	$ 391,880.53

The following gifts are for designated purposes:

ALUMNI FUND 1953–54	$ 207,919.05
ANONYMOUS	
For Urban and Regional Studies—general	2,500.00
SAMUEL BERKE '15	
For Samuel Berke Humanities Fund	5,000.00
E. S. CHAPIN '98	
For Class of 1898 Fund	100.00
R. E. CURTIS '15	
For R. E. Curtis Scholarship	4,000.00
THE GABRIEL COMPANY	
For industrial fellowships in electronics	3,000.00
L. D. GARDNER '98	
For Class of 1898 Fund	100.00
GENERAL FOODS CORPORATION	
For Food Technology Fund	10,000.00
GERBER FOOD PRODUCTS COMPANY	
For Food Technology Fund	10,000.00
GOODYEAR TIRE AND RUBBER COMPANY	
For Industrial Economics Graduate Fellowship	2,500.00
CRAWFORD H. GREENEWALT '22	
For Greenewalt Basic Research	9,771.12
LAWRENCE F. HARRIS '30	
For Research Laboratory of Electronics	150.00
HARVARD UNIVERSITY	
For W. T. Sedgwick Fund	30.37
INDUSTRIAL RELATIONS FUND	
Contributions from industrial concerns	17,200.00
OSCAR MAYER & COMPANY	
For Food Technology Fund	10,000.00
CHARLES E. MERRILL	
For Charles E. Merrill Fund	487.50
MINOT DEBLOIS AND MADDISON	
For Urban and Regional Studies	2,500.00
ESTATE OF C. LILLIAN MOORE	
For John A. Grimmons ('21) Fund	5,790.00
WESTINGHOUSE EDUCATIONAL FOUNDATION	
For Industrial Economics graduate fellowships	2,500.00
	$ 293,548.04

UNINVESTED FUNDS

SUPPORT OF THE INDUSTRIAL LIAISON PROGRAM..... $1,225,453.12

A partial list of companies making payments in 1953-54:

Allegheny Ludlum Steel Corporation
Aluminum Company of America
American Can Company
American Machine and Foundry Company
Anaconda Copper Mining Company
Armco Steel Corporation
Atlantic Refining Company
The Budd Company
Cities Service Research and Development Company
Continental Can Company, Incorporated
Continental Motors Corporation
Continental Oil Company
The Dow Chemical Corporation
Electrolux Corporation
Gulf Research and Development Company
Hercules Powder Company
John Hancock Mutual Life Insurance Company
Lever Brothers Company
Liquid Carbonic Corporation
The Lummus Company
The Mead Corporation
Merck and Company, Incorporated
Minneapolis-Honeywell Regulator Company
North American Aviation, Incorporated
Norton Company
Olin Industries, Incorporated
Owens-Corning Fibreglas Corporation
Philco Corporation
Pittsburgh Plate Glass Company
Radio Corporation of America
Raytheon Manufacturing Company
A. O. Smith Corporation
Socony-Vacuum Oil Company, Incorporated
Sperry Gyroscope Company
Standard Oil Company of California
Standard Oil Company (Indiana)
Stone & Webster Engineering Corporation
Sylvania Electric Products, Incorporated
Texas Company
United Aircraft Corporation

The following gifts are for student aid:

ALLOY STEEL PRODUCTS COMPANY
For undergraduate scholarship..... $ 1,200.00

ALUMNI ASSOCIATION
For undergraduate scholarship (special)..... 250.00

AMERICAN BRAKE SHOE COMPANY
For undergraduate scholarship (special)..... 1,800.00

AMERICAN CHICLE COMPANY	
For scholarships	$ 2,700.00
AMERICAN SMELTING AND REFINING COMPANY	
For undergraduate scholarship	1,000.00
AMERICAN SOCIETY FOR METALS	
For undergraduate scholarship (special)	400.00
ANONYMOUS	
For Foreign Student Fund "L"	2,000.00
ANONYMOUS	
For undergraduate scholarship (special)	1,000.00
ARMCO FOUNDATION	
For undergraduate scholarship (special)	1,800.00
BOSTON STEIN CLUB	
For Boston Stein Club Technion Fund	637.50
For Boston Stein Club Freshman Scholarship	410.00
For Boston Stein Club Scholarship and Loan Fund Special Funds	
Anonymous	500.00
Bernat, George A. '28 and Ruth D.	250.00
Bernstein, David W. '31 and Irene	500.00
Cooper, Benjamin '33	500.00
Gens, Morris H. '22	500.00
Groisser & Shlager Iron Works	500.00
Horovitz, Oscar H. '22 and Mary C.	100.00
Marcus, Richard J. '32 and Diane L.	500.00
Wechsler, Albert H. '21 and Pearl K.	500.00
BRUMBERGER FOUNDATION, INCORPORATED	
For undergraduate scholarship	500.00
CINCINNATI MILLING MACHINERY COMPANY	
For scholarship	6,000.00
CLERITE FOUNDATION	
For undergraduate scholarship	1,000.00
EARL CLIFF	
For undergraduate scholarship	250.00
THOMAS C. DESMOND '09	
For Thomas C. Desmond Scholarships	1,200.00
DOW CORNING CORPORATION	
For undergraduate scholarship	900.00
PHILIP B. DOWNING TRUST	
For Philip B. Downing Scholarship	540.00
MARCY EAGER	
For scholarship	50.00
FLUOR FOUNDATION	
For fellowship	3,000.00
ALFRED T. GLASSETT '20	
For undergraduate scholarships	300.00
HARTSDALE CHAMBER OF COMMERCE	
For undergraduate scholarship (special)	200.00
HIGHBOUGH FOUNDATION, INCORPORATED	
For scholarships	100.00
HOLMES AND NARVER, INCORPORATED	
For scholarships	10,000.00
HOUSTON ENDOWMENT, INCORPORATED	
For William S. Knudson Fellowship	2,500.00

RICHARD W. INCE	
For undergraduate scholarship (special)	$ 400.00
INTERNATIONAL BUSINESS MACHINES COMPANY	
For fellowships	9,600.00
INTERCOLLEGIATE CLUB OF BOSTON	
For scholarship	450.00
JAKOBSON SHIPYARD INCORPORATED	
For undergraduate scholarships	1,000.00
CHARLES S. JONES	
For scholarships	4,500.00
KENNECOTT COPPER COMPANY	
For scholarships	2,000.00
JAMES R. KILLIAN, JR. '26	
For James R. Killian, Jr., Fund	200.00
KNAPP FUND	
For undergraduate scholarships	1,500.00
THE KULJIAN CORPORATION	
For undergraduate scholarship (special)	2,000.00
LOCKHEED AIRCRAFT CORPORATION	
For undergraduate scholarships	1,900.00
M. I. T. CLUB OF NEW YORK	
For scholarships	450.00
EDNA MCCONNELL CLARK FOUNDATION	
For undergraduate scholarships	5,100.00
JAMES C. MELVIN TRUST	
For scholarships	9,000.00
LEONARD L. MINTHORNE	
For undergraduate scholarships	200.00
NATIONAL ASSOCIATION OF ENGINE AND BOAT MANUFACTURERS	
For undergraduate scholarship (special)	1,800.00
ERNEST L. OSBORNE	
For scholarship	100.00
THEODORE & MARJORIE RHODES FOUNDATION	
For undergraduate scholarships	250.00
SKIDMORE, OWINGS & MERRILL	
For undergraduate scholarships	1,200.00
ALFRED P. SLOAN ('95) FOUNDATION	
For student travel	660.00
For Sloan National Scholarships	33,300.00
SYMINGTON GOULD CORPORATION	
For undergraduate scholarships	1,500.00
TEAGLE FOUNDATION, INCORPORATED	
For scholarships	19,986.00
TRANSPARENT PACKAGE COMPANY FOUNDATION	
For undergraduate scholarships	900.00
UNDERGRADUATE SCHOLARSHIP SPECIAL	
Contributions	1,550.00
UNION CARBIDE & CARBON COMPANY	
For undergraduate scholarships	1,100.00
WESTINGHOUSE EDUCATIONAL FOUNDATION	
For Science Teachers Fellowships	12,500.00
ROBERT WINTHROP	
For scholarships	2,000.00
	$158,733.50

The following gifts are for designated purposes:

ACUSHNET PROCESS COMPANY	
Miller and Commons Room Fund	$ 300.00
AEROFALLS MILLS	
Research in metallurgy	1,260.63
ALLIED CHEMICAL AND DYE CORPORATION.	
For fellowships in chemical engineering	2,900.00
For fellowship in chemistry	2,400.00
ALLIS CHALMERS MANUFACTURING COMPANY	
For research in metallurgy	2,500.00
AMERADA PETROLEUM COMPANY	
For geophysical analysis research	800.00
AMERICAN BRAKE SHOE COMPANY	
For fellowship in metallurgy	3,500.00
For research in metallurgy	5,000.00
AMERICAN CANCER SOCIETY	
For research in biology	7,560.00
For fellowship in biology	500.00
AMERICAN CYANAMID COMPANY	
For fellowship in chemistry	2,700.00
For soil stabilization research	4,583.34
AMERICAN CHICLE COMPANY	
For fellowship in chemistry	7,800.00
For fellowship in food technology	2,500.00
For research in chemistry	3,400.00
AMERICAN FOUNDRYMEN'S SOCIETY	
For research in metallurgy	5,000.00
AMERICAN IRON AND STEEL INSTITUTE	
For corrosion research	4,000.00
For research in humanities	4,297.00
AMERICAN SOCIETY OF MECHANICAL ENGINEERS	
For research in chemistry	2,000.00
AMERICAN SOCIETY OF REFRIGERATING ENGINEERS	
For research in mechanical engineering	900.00
ANONYMOUS	
For Food Technology Department	200.00
ARMCO FOUNDATION	
For fellowship in physics	3,000.00
ARMOUR AND COMPANY	
For research in biology	12,000.00
For dry cyaniding research	3,750.00
ATLANTICA DEL GOLFO	
For Cuban sugar research	6,250.00
ATLANTIC REFINING COMPANY	
For geophysical analysis research	3,000.00
BARIUM STEEL COMPANY	
For fellowship in mechanical engineering	3,000.00
BETHLEHEM STEEL COMPANY	
For research in metallurgy	2,000.00
RUTH BISPLINGHOFF	
For aeroelastic laboratories	83.50
EDWARD L. BOWLES	
For library of chamber music	500.00
PROFESSOR CHARLES B. BREED '97	
For Breed Fund in Civil Engineering	200.00

BRISTOL LABORATORIES, INCORPORATED	
For research in chemistry	$ 8,000.00
BRYANT CHUCKING GRINDER COMPANY	
For research in mechanical engineering	17,800.00
BUFFALO ELECTRIC CHEMICAL COMPANY	
For research in soil stabilization	5,000.00
GODFREY L. CABOT '81	
For Foreign Student Summer Project	500.00
CALIFORNIA RESEARCH CORPORATION	
For geophysical analysis research	3,000.00
CAMPBELL SOUP COMPANY	
For research in food technology	1,700.00
CARBORUNDUM COMPANY	
For research in mechanical engineering	20,000.00
CARNATION COMPANY	
For research in food technology	5,000.00
CITIES SERVICE OIL COMPANY	
For geophysical analysis research	3,000.00
E. L. COCHRANE '20	
For Naval Architecture Department	1,100.00
COFFEE BREWING INSTITUTE	
For research in food technology	16,350.00
For fellowship in food technology	2,500.00
COMMONWEALTH FUND	
For fellowship in medical department	4,500.00
For research in biology	35,100.00
CONSOLIDATED CAR HEATING COMPANY	
For research in metallurgy	500.00
CONTINENTAL OIL COMPANY	
For geophysical analysis research	7,000.00
CONTINENTAL SCREW COMPANY	
For Miller and Commons Rooms	1,000.00
CORNING GLASS WORKS	
For research in metallurgy	2,000.00
CURTISS-WRIGHT COMPANY	
For cascade research	20,000.00
DEARBORN CHEMICAL COMPANY	
For corrosion research	250.00
DEWEY AND ALMY CHEMICAL COMPANY	
For research in chemical engineering	2,155.70
DOUGLAS AIRCRAFT COMPANY	
For fellowships	3,000.00
E. I. DUPONT DE NEMOURS AND COMPANY, INCORPORATED	
For fundamental research in chemistry	30,000.00
For fellowship in chemical engineering	4,560.00
For fellowship in chemistry	3,440.00
For fellowship in mechanical engineering	4,200.00
For fellowship in physics	4,200.00
ELASTIC COLLOID RESEARCH CORPORATION	
For Crawford Fellowship in Chemical Engineering	2,500.00
ELECTRO METALLURGICAL COMPANY (DIVISION OF UNION CARBIDE)	
For research in metallurgy	6,600.00
ELECTROLUX CORPORATION	
For research in mechanical engineering	5,000.00
EMERSON AND CUMINGS, INCORPORATED	
For Plastic Materials Manufacturing Association	100.00

ENGINEERING FOUNDATION	
For corrosion research in civil engineering	$ 2,000.00
For research in metallurgy	10,000.00
ENGINEERING PRECISION CASTING COMPANY	
For research in metallurgy	150.00
ETHICON SUTURES LABORATORY, INCORPORATED	
For research in biology	5,000.00
ETHYL CORPORATION	
For fellowship in mechanical engineering	3,300.00
For research in chemistry	3,800.00
EXOMET, INCORPORATED	
For research in metallurgy	6,300.00
FEDERAL RESERVE BANK OF BOSTON	
For study in city and regional planning	1,500.00
CHARLES N. FREY	
For Food Technology Department	45.19
FORD FOUNDATION	
For Ford Foundation—Pool	4,156.40
For research in utilization of human resources	37,000.00
For educational conference	9,000.00
For general purposes	500.00
FOUNDRY EDUCATIONAL FOUNDATION	
For scholarship in metallurgy	4,500.00
For research in metallurgy	500.00
FOREIGN STUDENTS SUMMER PROJECT	
Miscellaneous contributions	1,625.00
FRIENDS OF MUSIC AT M. I. T.	
Contributions	290.00
GENERAL ELECTRIC COMPANY	
For cascade research	20,000.00
For fellowship in chemistry	3,300.00
For fellowship in electrical engineering	1,200.00
For fellowship in metallurgy	2,600.00
GERBER FOOD PRODUCTS COMPANY	
For research in food technology	2,500.00
GENERAL MOTORS CORPORATION	
For fellowship in chemical engineering	3,000.00
For fellowship in mechanical engineering	6,000.00
DONALD B. GILLIES, JR. '41	
For School of Industrial Management	1,000.00
GIVAUDAN CORPORATION	
For research in chemistry	3,000.00
For research in biochemistry	4,000.00
GODFREY HYAMS TRUST	
For high voltage research in electrical engineering	23,500.00
B. F. GOODRICH CHEMICAL COMPANY	
For research in textiles	5,500.00
GOTTESMAN FOUNDATION	
For fellowship in chemical engineering	1,050.00
GRADUATE HOUSE EXECUTIVE COMMITTEE	
For Crafts Library	225.00
EARLE A. GRISWOLD '23	
For Proctor Portrait Fund	100.00
HERBERT GRUNFELD TRUST	
For metallurgy equipment	250.00

GULF OIL RESEARCH AND DEVELOPMENT COMPANY	
For fellowship in physics	$ 1,500.00
For geophysical analysis research	3,000.00
BRYANT HALIDAY	
For general purposes	75.00
HARVARD UNIVERSITY	
For research in history	1,200.00
For research in biology	1,000.00
HENLEY REGATTA FUND	
Contributions	6,588.83
HOPEDALE FOUNDATION	
For Dean Baker Fund	500.00
HUMBLE OIL COMPANY	
For fellowship in chemical engineering	2,700.00
JEROME C. HUNSAKER '12	
For Aeronautical Engineering Department	1,000.00
ELMER C. INGRAHAM '26	
For Research Laboratory of Electronics	2,000.00
JOHNSON AND JOHNSON COMPANY	
For research in biology	5,000.00
HARRY KALKER '23	
For Proctor Portrait Fund	100.00
M. W. KELLOGG COMPANY	
For research in mechanical engineering	10,000.00
CARL KELLER	
For Library	150.00
KENNECOTT COPPER COMPANY	
For research in metallurgy	3,000.00
CHARLES F. KETTERING FOUNDATION	
For research in biology	8,310.00
For research in chemistry	15,000.00
KIMBERLY CLARK CORPORATION	
For fellowship in chemical engineering	4,100.00
ESTATES OF CHARLES A. '96 AND MARJORIE KING	
For research in biology	10,000.00
THEODORE H. KRUEGER '14	
For School of Industrial Management	500.00
ELI LILLY COMPANY	
For research in biology	8,000.00
For research in chemistry	4,000.00
ARTHUR D. LITTLE, INC.	
For research in chemistry	3,500.00
LORD MANUFACTURING COMPANY	
For research in building engineering and construction	4,400.00
MAGNOLIA PETROLEUM COMPANY	
For geophysical analysis research	3,000.00
MANUFACTURING CHEMISTS' ASSOCIATION, INCORPORATED	
For research in building engineering and construction	19,326.64
MARLBORO WIRE GOODS COMPANY	
For Miller and Commons Rooms	500.00
NEWMAN M. MARSILIUS '17	
For School of Industrial Management	1,000.00
SAMUEL A. MARX '07	
For Samuel A. Marx Architecture Fund	1,000.00

COMMONWEALTH OF MASSACHUSETTS	
For highway project in civil engineering	$ 30,000.00
MASSACHUSETTS GENERAL HOSPITAL	
For research in biology	500.00
MATHIESON CHEMICAL COMPANY	
For research in soil stabilization	5,000.00
THE MCCLINTIC ENDOWMENT	
For fellowship in civil engineering	2,400.00
MERRILL FOUNDATION	
For research in industrial relations	28,000.00
PROFESSOR NICHOLAS A. MILAS	
For research in chemistry	7,225.00
MILLER AND COMMONS ROOMS IN MECHANICAL ENGINEERING	
Contributions	6,041.00
MINNEAPOLIS HONEYWELL REGULATOR COMPANY	
For fellowship in electrical engineering	5,400.00
MONSANTO CHEMICAL COMPANY	
For plastics research in housing design	5,000.00
MUCHNIC FOUNDATION	
For fellowship in metallurgy	3,000.00
MUSCULAR DYSTROPHY ASSOCIATION OF AMERICA	
For research in biology	4,374.00
NATIONAL ACADEMY OF SCIENCES	
For research in naval architecture	2,250.00
NATIONAL FOUNDATION FOR INFANTILE PARALYSIS	
For calcium research in food technology	45,878.00
For research in biochemistry	1,000.00
For research in chemistry	1,000.00
NATIONAL GEOGRAPHIC SOCIETY	
For Edgerton film research in electrical engineering	8,215.00
NATIONAL GYPSUM COMPANY	
For research in metallurgy	2,500.00
NATIONAL INSTITUTES OF HEALTH	
For fellowship in Medical Department	1,800.00
NATIONAL LIME ASSOCIATION	
For research in building engineering and construction	7,000.00
NATIONAL METAL TRADES ASSOCIATION	
For research in industrial management	750.00
NATIONAL PNEUMATIC COMPANY, INCORPORATED	
For research in electrical engineering	5,000.00
NATIONAL RESEARCH CORPORATION SCIENTIFIC TRUST	
For research in chemical engineering	3,200.00
NATIONAL SCIENCE FOUNDATION	
For research in chemistry	5,400.00
OFFNER PRODUCTS CORPORATION	
For Research Laboratory of Electronics	1,000.00
PAN AMERICAN REFINING COMPANY	
For fellowship in chemical engineering	2,500.00
PHILLIPS PETROLEUM COMPANY	
For geophysical analysis research	3,600.00
PITTSBURGH CONSOLIDATION COAL COMPANY	
For research in chemical engineering	600.00

PROCTER AND GAMBLE COMPANY	
For fellowship in chemical engineering	$ 4,200.00
For fellowship in mechanical engineering	2,600.00
For scholarship in food technology	2,700.00
For research in food technology	14,000.00
UNIVERSITY OF PUERTO RICO	
For Puerto Rico economic relations study in city planning	5,750.00
WILLIAM LOWELL PUTNAM	
For Putnam Fund in Mathematics	200.00
PUNTA ALEGRE SUGAR COMPANY	
For Cuban sugar research	6,250.00
SIDNEY H. RABINOWITZ & FAMILY FOUNDATION	
For Food Technology Department	1,000.00
RAYTHEON MANUFACTURING COMPANY	
For research in food technology	8,000.00
RESEARCH CORPORATION	
For research in chemistry	7,500.00
For research in metallurgy	3,000.00
REVERE COPPER AND BRASS COMPANY	
For research in building engineering and construction	10,000.00
RONALD H. ROBNETT MEMORIAL FUND	
Contributions for fund in industrial management	1,667.50
ROCKEFELLER FOUNDATION	
For research in geology	8,775.00
For research in chemistry	13,820.11
For research in modern languages	7,300.00
ROHM AND HAAS COMPANY	
For research in soil stabilization	5,000.00
THEODORE ROOSEVELT ASSOCIATION	
For Roosevelt research project in humanities	45.48
DAMON RUNYON MEMORIAL FOUNDATION	
For research in biochemistry	11,000,00
For research in electrical engineering	20,000.00
SCHELL ROOM FUND IN INDUSTRIAL MANAGEMENT	
Additional contributions	68.00
SHARP & DOHME, INCORPORATED	
For research in chemistry	4,000.00
SHELL FELLOWSHIP COMMITTEE	
For fellowship in mechanical engineering	2,800.00
For research in mechanical engineering	5,000.00
For research in metallurgy	5,000.00
For fellowship in physics	2,800.00
For research in physics	5,000.00
SIMMONS COMPANY	
For research in mechanical engineering	1,500.00
ALFRED P. SLOAN ('95) FOUNDATION INCORPORATED	
For Foreign Student Summer Project	33,500.00
For Executive Development Program	100,000.00
For School of Industrial Management	275,000.00
GEORGE A. SLOAN	
For Friends of Music at M. I. T.	100.00
SOCIAL SCIENCE RESEARCH COUNCIL	
For faculty research fellowship	3,600.00
SOCIETY OF INDUSTRIAL PACKAGING AND HANDLING ENGINEERS	
For research in mechanical engineering	781.00

SPOOL COTTON COMPANY	
For Coats and Clark, Incorporated, Fellowship	$ 5,400.00
STANDARD OIL DEVELOPMENT COMPANY	
For geophysical analysis research	3,000.00
STANOLIND OIL AND GAS COMPANY	
For research in soil stabilization	2,000.00
For geophysical analysis research	3,000.00
STEEL FOUNDERS' SOCIETY OF AMERICA	
For research in metallurgy	2,001.00
SUGAR RESEARCH FOUNDATION	
For research in food technology	6,375.00
SUN OIL COMPANY	
For geophysical analysis research	4,400.00
TEXAS INSTRUMENT, INCORPORATED	
For research in geology	2,000.00
For geophysical analysis research	4,400.00
TITANIUM ALLOY MANUFACTURING COMPANY	
For research in metallurgy	1,500.00
TIMKEN ROLLER BEARING COMPANY	
For research in mechanical engineering	6,000.00
For research in metallurgy	5,000.00
TROPIC FRUIT, INCORPORATED	
For research in food technology	6,000.00
UNION CARBIDE & CARBON COMPANY	
For fellowship in chemistry	3,300.00
For fellowship in metallurgy	1,100.00
UNITED GEOPHYSICAL COMPANY	
For geophysical analysis research	3,000.00
UNITED STATES RUBBER COMPANY	
For fellowship in chemistry	3,300.00
VANADIUM ALLOY STEEL COMPANY	
For fellowship in metallurgy	3,500.00
VERTIENTES-CAMAGUEY SUGAR COMPANY OF CUBA	
For Cuban sugar research	6,250.00
VIOLETA SUGAR COMPANY	
For Cuban sugar research	6,250.00
VISKING CORPORATION	
For fellowship in mechanical engineering	2,500.00
WESTINGHOUSE EDUCATIONAL FOUNDATION	
For professorship in mechanical engineering	15,000.00
ESTATE OF HENRY A. WENTWORTH	
For Henry A. Wentworth Fund	2,000.00
TITUS WERNER	
For high voltage research in electrical engineering	1,000.00
WESTINGHOUSE ELECTRIC CORPORATION	
For cascade research	20,000.00
HOWARD D. WILLIAMS '11	
For School of Industrial Management	500.00
WORTHINGTON CORPORATION	
For research in mechanical engineering	2,500.00
WYMAN GORDON COMPANY	
For fellowship in metallurgy	2,500.00
YALE UNIVERSITY	
For Stimson Fund in Industrial Management	8,000.00
	$1,497,648.32

OTHER GIFTS

The following gifts are added to agency funds held by the Institute for investment purposes:

E. Sherman Chase '06		
For Class of 1906	$	1,053.10
Class of 1905		
Contributions of class members		6,600.00
Class of 1910		
Contributions of class members		1,223.00
Class of 1916		
Contributions of class members		3,033.12
Class of 1917		
Contributions of class members		3,509.23
Class of 1929		
Contributions of class members		507.31
Class of 1933		
Contributions of class members		452.62
Class of 1935		
Contributions of class members		510.38
Class of 1937		
Contributions of class members		905.88
Class of 1944		
Contributions of class members		440.95
Class of 1944 (special)		
Contributions of class members		1,781.15
Class of 1949		
Contributions of class members		391.59
Other Classes		
Contributions of class members		370.70
John W. Kilduff for Class of 1918		
Contributions		1,500.00
M. I. T. Women's Dormitory Fund		
For Women's Association Fund		424.47
For Lillie C. Smith Fund		898.96
Paul M. Paine '04		
Class of 1904		2,368.65
Sailing Pavilion Fund		
Contributions		200.00
	$	26,171.11

The following gifts are added to annuity funds:

George S. Witmer '09		
For George S. Witmer Fund	$	6,625.00

SUMMARY OF GIFTS, GRANTS AND BEQUESTS RECEIVED

	1954	1953	1952	1951	1950
Gifts for endowment:					
Funds for general purposes	$ 82,558	$ 50,128	$ 7,740	$ 86,586	$1,030,511
Funds for designated purposes	677,230	538,077	340,532	523,599	382,069
Gifts for student loans	9	905	2,973	227,756	10
Gifts for building funds	274,400	15,004	40,308	3,797,212	1,268,266
Other gifts:					
Unexpended balances of endowment fund income	7,786	5,800	5,425	5,775	2,525
Funds for general purposes — invested	391,881	1,403,533	2,850,889	2,206,364	2,066,934
Funds for designated purposes — invested	293,548	1,108,931	1,537,653	554,665	245,454
Funds for designated purposes — not invested	2,881,835	2,796,288	2,093,875	1,657,399	1,463,763
	$4,609,247	$5,918,666	$6,879,395	$9,059,356	$6,459,532
Miscellaneous gifts:					
Agency funds	$ 26,171	$ 38,728	$ 45,711	$ 38,751	$ 18,247
Annuity funds	6,625	24,500	28,000	47,000	50,310
	$ 32,796	$ 63,228	$ 73,711	$ 85,751	$ 68,557
Total	$4,642,043	$5,981,894	$6,953,106	$9,145,107	$6,528,089

Reports of Other Administrative Officers

Secretary of the Institute

This past year has seen several organizational changes which have been made to simplify and strengthen the Institute's administration. The establishment of the position of Vice-President for Industrial and Governmental Relations and the concurrent reallocation of administrative responsibilities have made it possible for the activities of the Secretary of the Institute to be concentrated on those functions which most directly affect the Institute's general development program. These include the Development Office and the Educational Council. Any report on these activities, however, should also review the operations of certain other offices, not under the administrative supervision of the Secretary of the Institute, which support the Insti-

tute's external relations program, such as the Industrial Liaison Office, Office of Publications and News Service. A brief report on each of the above for the past fiscal year is presented in the sections which follow.

On June 15, 1954, Mr. Robert M. Kimball took over the duties of the Secretary of the Institute, replacing Professor Walter H. Gale, who asked to be relieved of administrative duties to devote full attention to plans for future development at the Institute.

Development Office. During the year 1953–54, fund-raising efforts were devoted to three main types of objectives. First, and most important, was the strengthening of the Institute's over-all financial position through the increase in permanent funds, including endowment for general and designated purposes. A second objective was the obtaining of funds for current operations, including grants-in-aid for research and other special purposes. A third phase of the Institute's continuing development program was the solicitation of funds for certain special objectives which are of an immediate, rather than long range, nature. Among these were the Allan Winter Rowe Memorial Fund for Crew, which increased during the year from $4,870.58 to $20,585.96, toward the goal of $50,000; the Edward F. Miller Memorial Room for the Department of Mechanical Engineering, funds for which total $16,215; the Henley Regatta Fund, to help finance the trip to England of the 150-pound crew, for which $5,492.50 was raised by the Development Office; and the Organ Fund, to purchase the organ for the new auditorium. Efforts on this latter campaign have produced a little less than $10,000 toward the necessary $50,000.

In addition, the Development Office has continued its long-range bequest program through direct mailings to alumni and to selected individuals throughout the country, some 9,000 of whom have already received the solicitation literature.

Contributions amounting to $12,300 were received from a group of "small companies" who had previously responded to the intensive Development Drive. These gifts were obtained through letters and personal calls.

The Educational Council. Membership in the Council now totals 516 alumni, as compared with 448 in June, 1953, and 351 in

June, 1952. The present total includes 236 Honorary Secretaries and 280 Educational Counselors. In addition to these domestic representatives, there are 37 Honorary Secretaries located in foreign countries, bringing the total number of Honorary Secretaries and Educational Counselors to 553.

At the present time, organization of the Council is complete or in progress in 131 areas located in 41 states (plus Washington, D. C., and Hawaii). Of these areas, 88 are fully active and Council members within them are working with 661 secondary schools. In the remaining 43 areas, organization is under way but contact with schools has not yet been established.

Although the future is always difficult to predict, there is every reason to believe that the rapid growth of the Council's field organization will continue throughout the coming year. During this period, the 43 areas now in the process of organization should become fully active. Tentative plans also call for the development of Educational Council activity in approximately forty additional areas during the next twelve months.

Regular monthly publication of the *Bulletin* was continued during the academic year — eight issues having been mailed to Council members during that period. The primary responsibility for these issues of the *Bulletin* was assumed by Mr. Walter L. Milne, who, in his capacity as Administrative Assistant in the Educational Council office, also played a major role in all of the other activities of the office during the period covered by this report.

All of the available evidence to date reaffirms the wisdom of the initial decision to lay strong emphasis upon service to others in the over-all Council program. Clearly, this emphasis constitutes not only good public relations but also a valid means by which M.I.T. can contribute to the general welfare of the communities in which its representatives are active. Every attempt should be made to expand this effort and to increase its effectiveness.

This report would not be complete without expressing again the Institute's keen awareness of the great debt that it owes to the many alumni who, as Council members, are contributing so much to this program. The continuing support of these men is essential to the Institute's future welfare, and its indebtedness to them will unquestionably increase in the years ahead.

The organization and continued growth of the Educational Council, as well as the effectiveness of its operations, are attributable to the imaginative and energetic efforts of the Council's Executive Secretary, Mr. Arthur L. Bryant. Mr. Bryant's resignation, effective August 1, 1954, to take a position in industry will be keenly felt by his friends at the Institute and among the alumni who have worked with him through the Educational Council. We are fortunate in having, as his successor, an M.I.T. alumnus and staff member, Mr. Bruce F. Kingsbury, who comes to his new position with three years' experience in the Institute's Admissions Office.

The Industrial Liaison Office. The Industrial Liaison Program, in its sixth year of operation, now appears to be approaching a steady-state level of activity in its function of providing interchange of information between M.I.T. and certain industrial companies. The seventy companies represented are providing the Institute with major financial support of essentially unrestricted character, thereby alleviating to an important extent the heavy demand on the Institute's funds for current expenses. In turn, the purpose of the Liaison Program is to reciprocate in all ways appropriate to the traditions and policies of M.I.T. The Industrial Liaison Office is charged with assuring that the Institute's obligations under the Program are carried out. Despite the generally tighter financial situation in industry, it is gratifying to note that a number of companies whose agreements expired during the year have renewed on schedule.

The activity of the Liaison Office itself has increased considerably during the past year. This is apparently a result of greater appreciation within the companies of the value of the Liaison Program and a tendency for each company to become more concerned with benefits received. As in the past, the activities consisted principally of special meetings and symposia, individual visits to M.I.T. by company representatives, the distribution of reports and other printed material and the handling of numerous special situations and services.

In general the year saw a continuation of the second phase of the Industrial Liaison Program — the period during which the Liaison Office is reorganizing and modifying some details of the Program to prepare for long-term operation after the initial period

of sharp growth. The general policy has been to organize internally so as to perform the regular, or "core," services for the member companies as economically as possible, thereby to leave the Liaison Officers more freedom to concentrate on special situations requiring "tailored" treatment.

The featured means of achieving exchange of information during this year has been a series of private symposia. For the first time a number of these meetings were concentrated into a spring series and were announced simultaneously rather than individually. The innovation seems to have been successful and will be continued. Altogether, eleven symposia were held with an average attendance of 45 representatives at each. Fifty-five different companies participated in these meetings, sending a total of 495 representatives.

Arranging and monitoring visits by company representatives continues to be a major part of the Liaison activity. An informal log of visitors indicates a total of approximately 425 from some 64 different companies. These ranged from casual visits of brief duration to three-day intensive series of interviews with Faculty members on prearranged schedules.

Publications distribution has continued to be a major and growing item of Liaison activity. During the year the publications function has been re-staffed and a major reorganization of operating systems and procedures has been initiated. Regular mailings were made of 404 different publications, the average quantity of each being somewhat higher than previously. The Industrial Liaison Office has, with the co-operation of the Office of the Summer Session, provided the participating companies with advance notice of the Special Summer Programs designed for industry.

Among the special services rendered under the Program, mention should be made of the beginning of a new emphasis on visits by M.I.T. personnel to the participating companies. A number of Faculty members have participated, generally to their professional benefit as well as that of the companies. Communications between the Liaison Office and the Faculty have been given special attention in the form of two bulletins to the Faculty and a series of meetings of Industrial Liaison Office personnel with departmental staffs. It is planned to continue these meetings. By vote of the Faculty in April, the Faculty Committee on Industrial Liaison was made one of its standing committees.

In October, 1953, Walter L. Allison completed his term as Industrial Liaison Officer and was replaced by Dr. John O. Outwater, Jr., who started his duties in January, 1954, after the work had been temporarily covered by Dr. M. C. Flemings. Other Liaison Officers, in addition to the Director, William R. Weems, were Thomas Cantwell, Jr., Vincent A. Fulmer and Eugene B. Skolnikoff. At the end of the fiscal year, Harold R. Lawrence and Ralph L. Wentworth were added as replacements for Messrs. Cantwell and Skolnikoff, with the latter remaining for a few months for special duties.

Office of Publications. In its third year the Office of Publications has achieved a firmer feeling for the channels by which it may best meet its assignment as a service organization in the M.I.T. community. The Office is now organized to fulfill three sequential functions in publishing — each of essentially equal importance: editing, designing and producing. In all three the capacity is limited, both in quantity and breadth. One of the difficult problems is to equate uneven demand for services against the steady employment of professional people.

The creative aspect of the editorial efforts has the character of interpretation; the best service in this area seems to be in the help which can be given, by journalists, in communicating information — putting facts in the form most useful to those who will be the recipients, be they high school students, mature scientists, executives, teachers or alumni.

In many of these projects, matters of visual presentation and design are closely interrelated with editorial work, for what cannot easily be conveyed in words can often very effectively be shown in charts, diagrams and photographs. And especially in subtler ways, design and typography may create impressions of environment and attitude which no words can convey. The production function of the Office of Publications consists of choosing processes and printers and working with these craftsmen to insure the best technical results.

The Institute represents certain qualities and standards which are unique in American education. The Institute's publications should in the same way stand apart, reflecting before the public the qualities which distinguish the Institute. These, then,

seem among the characteristics to be sought in all M.I.T. publications: a concern for the wider understanding of scientific and technological ventures, which in publications may be fostered by skillful writing and editing; an urgent feeling for the relevance here of affairs of the human spirit, which may be reflected in attention to the language and the art which are our heritage; the need of a technological institution to be abreast of and indeed in the forefront of knowledge and progress, which may be shown in our confirmation of the contemporary and even the experimental in all phases of the graphic arts; and the maintenance of professional integrity and responsibility, which may be demonstrated by the standards of professional performance which are applied to the Institute's publishing endeavors.

News Service. The interest of nationally known magazine writers in various activities of the Institute continued to increase during the past year, and members of the News Service staff were active in co-operating with a large group of writers representing leading magazines. The winter meeting of the National Association of Science Writers at M.I.T. was a significant step in cementing this co-operative undertaking.

The News Service also co-operated actively in the preparation of several television programs which are to be presented in coast-to-coast distribution this autumn.

Because of the large number and variety of courses and conferences offered in the Summer Session program, distribution of news to more than 1,000 journals was particularly heavy.

WALTER H. GALE

Dean of the Graduate School

An important but unspectacular responsibility of graduate school administration is the development of a congenial climate for scholarly study and research. The establishment and continuing evolution of policies and procedures con-

ducive to such a climate involve supporting high and meaningful standards on the one hand, yet maintaining on the other that flexibility which assures management by underlying spirit rather than by rule. This is a subtle and delicate operation whose success hinges on the imagination, standards and good will of the policy-making body, the Committee on Graduate School Policy. The Dean reports with satisfaction on the notable combination of independent-mindedness with team play and of firmness with flexibility that is characteristic of this committee, as well as on the statesmanlike quality of its deliberations. These operations have an important influence upon the tone and character of the Graduate School.

In size, the student body of the Graduate School has grown slowly over the past five years, stabilized as it is by departmental quotas. These quotas are limited basically by the number of tenure Faculty and the facilities permitted by M.I.T. long-term resources. Our well-qualified applicants continue to exceed quotas, in some departments by a substantial factor, although the great increase in graduate offerings over the entire country may eventually cause a greater sharing of these well-qualified students.

Enrollments, degrees conferred and recent trends are shown in the following tables:

ADVANCED DEGREES CONFERRED, 1953–54

	S.M. *	*Engineer*	Sc.D.	Ph.D.	*Total*
September, 1953...	134	2	14	24	174
February, 1954.....	74	6	26	25	131
June, 1954.....	315	44	32	34	425
	523	52	72	83	730

* Includes M.Arch. and M.City Planning.

FIVE-YEAR DATA ON ENROLLMENT AND DEGREES

	1949–50	*1950–51*	*1951–52*	*1952–53*	*1953–54*
Enrollment, fall term....	1602	1663	1727	1879	1955
S.M. degrees.....	463	478	455	445	523
Engineer degrees.....	42	64	63	42	52
Sc.D. degrees.....	70	76	70	77	72
Ph.D. degrees.....	96	90	80	101	83
Total graduate degrees	671	708	668	665	730

Viewed in larger perspective, the growth of the Graduate School by decades during the entire Institute's history is presented in the following table.

DISTRIBUTION OF ALL DEGREES GRANTED BY M.I.T. FROM 1868 THROUGH 1953

Calendar Years (inclusive)	*Bachelor's*	*Master's*	*Engineer's*	*Doctor's*	*Total*
1868–84 (17 years)	362 (100%)	...	...	...	362 (100%)
1885–94	903 (99.6%)	5 (0.4%)	...	...	908 (100%)
1895–04	1890 (97.4%)	49 (2.6%)	...	...	1939 (100%)
1905–14	2509 (92.7%)	179 (6.5%)	...	21 (0.8%)	2709 (100%)
1915–24	4264 (83.8%)	750 (14.7%)	...	74 (1.5%)	5088 (100%)
1925–34	5073 (70.1%)	1925 (26.6%)	...	241 (3.3%)	7239 (100%)
1935–44	4598 (62.4%)	2207 (29.9%)	...	567 (7.7%)	7372 (100%)
1945–53	7310 (59.3%)	2676 (29.8%)	251 (2.0%)	1086 (8.9%)	12,323 (100%)
Totals	26,909 (70.9%)	8791 (23.2%)	251 (0.66%)	1989 (5.24%)	37,940 (100%)

Included in the 1953–54 graduate enrollment were approximately 200 officers of our armed services and 253 students from 42 countries other than the United States and Canada.

Subsidy of graduate students continues large, provided by M.I.T. fellowships, scholarships and staff appointments as well as by outside fellowships of which the excellent National Science Foundation awards are the most numerous. Statistics follow; note that the award-term figures are roughly double the number of award holders at any given time.

1953–54 AWARDS OF M.I.T. FELLOWSHIPS AND SCHOLARSHIPS

	Number of award-terms	*Amount*
Fellowships	342	$328,317.07
Scholarships	158	63,623.00
Staff awards	669	140,904.86
Total	1169	$532,844.93

Contributing to the splendid industrial support of graduate work are the following new fellowships for 1953–54, added to those previously established and listed in the catalogue: American Chicle Company in chemistry; Barium Steel Corporation; Coffee Brewing Institute; Eastman Kodak Company in physics; Fluor Foundation; Houdaille-Hershey Corporation; Minneapolis-Honeywell; Owens-Corning Fiberglas; and Voorhees, Walker, Foley and Smith.

The Graduate Student Organization, whose establishment was reported a year ago, is developing well. Significant activities of the organization have included welcoming new foreign students with practical assistance in the problems of adjustment, assisting department registration officers, formulating an important rationalization of the place of graduate degree holders in the Alumni Association, adopting a Graduate School ring (surprisingly popular), backing the growing *Graduate Student News* with an advisory board and carrying through to final adoption the writing and revision of a constitution and by-laws. Perhaps the most striking was a critical contribution to the funding from a new source, which saved the very popular Overseas Summer Fellowship Program from discontinuance. This was a praiseworthy and responsible exercise of initiative, confirming once again the Institute's conviction of the capacity of mature students for accepting responsibility. Subsequently two graduate students contributed significantly as members of the selection committee.

A new degree, Doctor of Philosophy in Biochemical Engineering, was authorized by the Corporation for recommendation by the Department of Food Technology with the collaboration of the Departments of Biology and Chemical Engineering, thus offering a broadly based preparation for important new and existing biochemical industrial operations.

With the increasing trend of Selective Service toward universal service the notably effective efforts of the Secretary of the Graduate School, Professor Ernest H. Huntress, toward obtaining a rational continuity of educational experience for present and prospective graduate students has been most valuable. The problem both with draft boards and with the military services on behalf of reserve officers is basically that of clearly identifying and stating the important issues in cases that are intrinsically persuasive for deferment or postponement in the national interest. This is an exacting and demanding task involving careful individual handling of many hundreds of cases yearly.

Our Graduate House continues as a valuable residential center for single graduate students with opportunities for the intermingling of ideas from many and diverse backgrounds, experiences, cultures and countries. Persistent waiting lists testify to the need for additional on-campus graduate living facilities.

For the future, our problems are continuing rather than acute. They include increasing graduate-student support, extending graduate-student housing, attracting graduate students of great promise and developing further opportunities for and participation in broadening experiences during the graduate years in addition to the intensive professional experience that must always be the center of graduate study.

HAROLD L. HAZEN

Dean of Students

As a result of many converging influences on individual students and the community, during the past year a subtle and exciting change has begun to take place in the attitude of students toward M.I.T. and their own education;in the attitudes of Faculty, students, staff and employees regarding the significance of a way of life in the M.I.T. community. The year has been marked by genuine concern about general education as an integral part of professional education; open discussion of those principles or basic values which are regarded as inherent in any community of free men and women; and gradual reorganization, at all levels, to preserve the long-standing traditions at M.I.T. of student management of community life and activity in accordance with the highest standards of performance, the general welfare of the Institute as a whole and the development of each student as a unique personality.

As these developments unfold, the Office of the Dean of Students becomes less an arbiter of disagreements, a dispenser of discipline and a haven for the lonely and maladjusted — and more the focal point of a "school" of community living, the coordinator of an increasingly decentralized and locally controlled plan of residence, guidance, recreation and self-management and the center of communication between students, Faculty, staff and employees.

A summary of significant developments and statistics is given below.

Guidance and Counseling. With the appointment of Mr. William Speer as Associate Dean of Students as of July 1, 1953, responsibility for the coordination of guidance and counseling was made his chief area of responsibility. Much progress has been made under his leadership in clarifying procedures, effecting better communication, developing a closer working relationship with the psychiatric staff of the Medical Department and developing closer ties between students and the ministers who have been assigned by their respective faiths to the Institute.

Following the experimental provision last year of one room in Walker Memorial for use of the clergy, two consultation offices were provided this year in the library, and regular office hours were maintained by several ministers.

Because student counseling has become a matter of such grave concern at M.I.T. as it has in all institutions of higher education, I include in this report a brief quotation from Dean Speer's report in which he outlines his philosophy of counseling:

"Counseling at the Institute rests on the conviction that in a community of scholars all that pertains to human life may be included in the relationship between older and younger scholars. It is based on the conviction that a student is entitled to the dignity of reaching his own conclusions and making his own decisions. It is based on the conviction that a teacher by his character and learning may influence a student without giving advice. To what extent a student may take counsel with a teacher on matters outside a field of formal knowledge will depend on both student and teacher, for people are different. But, in general, it is a central conviction that counseling is a natural part of the normal relationship between teacher and student. It is not a process in which an 'expert' advises a student who has a 'problem.'"

The Freshman Advisory Council. Miss Ruth L. Bean, Assistant to the Dean, continues to carry the responsibility of this office for the Freshman Advisory Council, working closely with the Chairman of the Council and Dean Speer. The Council has now developed clear policies of operation and represents one of the most significant recent developments at the Institute, with its influence being felt in many quarters. I quote from Miss Bean's report:

"The Freshman Advisory Council has now completed its second full year of operation with an increase in the number of members from 45 to 60. It has therefore been possible for each adviser to know his students better, since he is counseling only twelve to fourteen instead of twenty as was previously the case. For the first time this year, advisers were associated with sections in which students had interests similar to their own. This provided a common bond which fostered a more informal and friendly relationship.

"The Dean's Office continues to handle the administrative details of the Freshman Advisory Council under the direction of the Chairman and the Executive Committee and is the headquarters for record-keeping and general orientation. We have acted as a communication center to aid in establishing a closer relationship between the adviser, the instructors, the Medical Department and this office as a counseling center for the individual freshman. It is becoming more clearly understood by advisers that academic problems and difficulties cannot be separated from other aspects of a student's development and the factors of environment and social background must be considered and understood if we are to be successful in assisting students to adjust to this or any situation.

"In March of this year an all-day meeting was held at the Faculty Club to which all Council members were invited as well as key Faculty committee chairmen. The morning session was conducted as a series of group meetings, with Council members acting as group leaders. Many phases of the freshman's adjustment to the Institute and his life here were introduced for discussion. After luncheon the group discussions were summarized and some questions about admissions policy and procedures were presented by the Director of Admissions. President Killian attended the afternoon session and addressed the meeting. At the afternoon session also, Professor Francis Bitter announced his resignation as Chairman of the Council and introduced the new chairman, Professor Norman Dahl.

"To Professor Bitter we express our sincere appreciation for the interest and enthusiasm with which he guided the Council through its beginning year and a half."

Student Housing. After a six-months' leave of absence because of illness, Associate Dean Frederick G. Fassett returned this year to carry the responsibility of this office in student housing. The year marked the first time that full use was made of the undergraduate dormitory system which was completed by the addition of Burton House in 1951. On Registration Day, September 19, 1953, all the dormitories were full and a waiting list for rooms was established.

The second group of Faculty Residents assumed their duties in September and for the first time a married couple was in residence on the East Campus.

Following the many clarifications of policy and organization during the spring of 1953, student government did outstanding work in the dormitories during the year. House newspapers in each of the three undergraduate centers made for house spirit and facilitated communication. Greatly expanded evening meetings in the dormitories, with Faculty members as guests, were beneficial and enjoyed by both Faculty and students. It is significant to record that there was no serious disturbance of any kind in the dormitories during the year.

A dormitory leadership conference held at Tech House, Round Hill, in the fall was a valuable innovation. Discussion centered on the responsibilities of individual residents in student-managed dormitories.

The system of student advisers for freshmen established by the Freshman Coordination Committee was continued for the second year and was decidedly helpful in getting new students settled at the Institute. During the spring, an orientation course was given for next year's counselors by members of the Medical Department, the Dean's Office and the Faculty at the request of student government.

During the spring the Dormitory Council did an outstanding piece of work in conducting discussions about the Open House Rules preparatory to a review of the present rules by a Faculty committee during the coming year.

Charles J. Masison, Jr., Chairman of the Dormitory Council, received one of the 1954 Karl Taylor Compton Prize Awards for his work in the dormitories.

Women Students. In addition to her work with the Freshman Advisory Council, Miss Bean has assumed full administrative responsibility for women students at the Institute. I quote directly from her report:

"Although women students continue to be a small minority of the total student body, they have established themselves on a firm foundation and their status is being studied carefully in line with the Institute's prevailing educational policy. Dr. Stratton has accepted the chairmanship of an ad hoc committee for this study. The Women's Advisory Board, composed of Faculty wives and a representative of the Women's Alumnae Association, continues to operate in an advisory capacity, and we hope that the scope of its functions will be widened. We express our thanks to Mrs. L. F. Hamilton who has served so ably as chairman of this Board for the past three years. She has consented to continue as a member of the Board to lend her experience and to ensure continuity.

"There seems to be notable improvement in all avenues of communication between dormitory residents, commuters, alumnae and the Dean's Office. This office has now in reality become a center for all women's activities. While the social functions for women are still few in number, the quality is increasingly high. A very successful Christmas buffet was given by Dean and Mrs. Bowditch as has been the custom for the past two years. In addition, two teas were given by some of the Faculty wives and both were well attended.

"The results of the questionnaire sponsored jointly by the Women's Alumnae Association and this office have been given a preliminary study, and the final facts and figures will be published as soon as possible. The study has revealed that many M.I.T. women have put their technical training to excellent use and in addition have found time for marriage and the successful raising of families.

"Through co-operation with the Boston chapter of the Society of Women Engineers a 'Students' Night' was held in the Schell Room to which young women of high school age interested in science, mathematics and engineering were invited.

"Although the dormitory does not accommodate all who apply, we have made arrangements with the Students' House

on the Fenway so that we have a quota of rooms available to undergraduates. Three of our freshmen lived there this past year and seemed to have a very pleasant experience.

"We express our thanks to the many wives of Faculty members who have been so understanding of the problems of our young women and who have contributed to the solution of these problems."

Student Government and Activities. Also the winner of a Karl Taylor Compton Award in May, the M.I.T. student government organization completed and put into effect changes in the organization of student government itself which should go far in providing adequate consideration of major policy, improved representation and communication and more efficient management of student life on a decentralized basis. Through the work of its Judicial Committee on infractions of dormitory rules and by levying and collecting an all-student assessment for damages in the dormitories, student government clearly established in the eyes of the student community its responsibility and its authority.

Symbolic of the fine work done by student government were the oral presentations made to the Corporation Committee on Student Life and to the Corporation itself by several students in December.

Because of its importance in relation to what we believe is the part of student life most in need of attention and review, special mention is made of the Activities Council created under the reorganization. This group has started a review of the status of undergraduate activities and this coming year should be able to do much in improving the activities program.

Commendation is also made of the Student Union Committee which, by its work and through its report, has convinced the administration of the need, at the earliest possible time, of a building adjacent to the auditorium which will house student government, student activities and other related community functions.

The Graduate School. For several years students in the Graduate School have felt they were in many ways step-children in the M.I.T. community and in the Alumni Association. Particularly significant, therefore, has been the establishment during the last

year of a Graduate Student Council, the publishing of the *Graduate Student News*, and the formation within the Alumni Association of a special place for holders of graduate degrees. In recognition of his long-term service in building a community of interest and sense of identity among graduate students, as well as for his valuable contributions to the goals already mentioned, the third Karl Taylor Compton Award was given in May to Austin Whillier, Sc.D. 1953.

Religion at M.I.T. Looking forward to the time when the chapel and auditorium will be ready for use, Dean Speer and Mr. Robert J. Holden, newly appointed Executive Secretary of the Technology Christian Association as of September, 1953, have initiated discussions both within and without the Institute to the end that the community might express its interests and convictions relative to programs which might be developed. Informal meetings with the several ministers to students have been held at regular intervals, with members of the Faculty, members of the administration and prominent visitors often included. The new office of Vice-President of Religious Action was created by the T.C.A. cabinet. In co-operation with the Baker Memorial Committee and the formally organized student religious groups on campus, T.C.A. conducted a series of religious lectures and discussions. At the request of students, Mr. Holden taught a course in Bible during the second semester.

During the spring term the various Protestant ministers to students elected the Reverend Robert C. Holtzapple of the Westminster Foundation to be their spokesman before the Institute on interfaith matters. Consequently, an informal committee of three men, Mr. Holtzapple, Father J. Edward Nugent and Rabbi Herman Pollack, was formed and met frequently with Dean Speer and Mr. Holden, as well as with members of the Faculty and administration. At a special meeting of the T.C.A. Advisory Board, these three men outlined their work at the Institute in detail and answered questions. It was clear that a great deal more counseling and educational work of a religious nature is taking place at the Institute than is generally recognized by the Faculty and alumni.

Miscellaneous. Several happenings of the last year should be recorded in this report.

By vote of the Faculty, the Dean of Students was replaced as chairman ex officio of the Faculty Committee on Student Environment by a member of the Faculty.

As of July 1, 1954, the Dean of Students replaced the Executive Assistant to the President as Chairman of the Undergraduate Budget Board, reflecting the increased participation of graduate students in student community life.

Provision has been made for a fourth Faculty Resident, as of September, 1954, in the south end of Crafts, East Campus.

An informal council composed of Faculty and administration members charged with responsibility in student life was formed and met at regular intervals during the year, thus clarifying policy and improving communications.

Eight members of the Class of 1957, the first holders of the new Sloan National Scholarships, along with other holders of national or major scholarships, met during the year with members of the Faculty and administration for dinner and discussion.

Conclusion. Professor Holt Ashley has resigned as Faculty Resident on the East Campus. A special debt of gratitude is owed to both Professor and Mrs. Ashley for the pioneering work they did with selflessness and considerable personal sacrifice.

In conclusion, may I express on behalf of Mrs. Bowditch and myself our gratitude for the warm support and friendly assistance extended to us by all members of the Institute family.

E. Francis Bowditch

Director of Student Aid

In an endeavor to offset the tuition increase that became effective in July, 1953, financial assistance to our student body during the academic year 1953–54 reached new high levels in total sums granted, both in scholarships and

loans: $292,105 in undergraduate scholarships and $326,312 in loans, making a total of $618,417. In addition to these grants, $225,500 has been earned by students employed on the student staffs for the dining services and residence halls and in assignments in the libraries and other divisions of the Institute. In summary, 40 per cent of our students have been assisted, either directly or indirectly, by the Student Aid Center, to the extent of $850,000.

Student Employment. For the purpose of annual record it would be desirable to report the accurate number of students employed with their gross earnings. This, however, is not possible, as a certain fraction of our students show sufficient initiative and enterprise to seek out employment without our assistance. In a brief survey of about one-quarter of our undergraduates conducted this spring, it was learned that seventy underclassmen had obtained jobs independently and were earning $22,000 during the year. The balance of this report is limited to those students placed by the staff of the Student Aid Center.

STUDENT EMPLOYMENT DURING 1953–54

	Number of Students	*Earnings*
Student staffs (dining and residence halls)	500	$112,462
Placement, other part-time work	674	113,053
	1174	$225,515

Efforts were continued, as reported last year, to assist undergraduates in summer jobs. A modification was employed this spring by arrangement with the Student Placement Office through which juniors could learn of the industrial organizations having summer openings, particularly where opportunities were available in line with the student's professional interests. Four hundred freshmen and sophomores were counselled about summer work, and by the close of the college year some 30 per cent of this number had been placed in the Boston area. With the exception of summer placement within the metropolitan area of Boston, our chief service has been to counsel and make suggestions. This is the maximum that we are able to accomplish within the limits of our staff. It will not be possible to make an estimate of summer earnings.

It is presumed that the new proposed Internal Revenue Act, when finally adopted, will do much to stabilize student employment, particularly by allowing family exemption for a student who earns toward his college expenses sums greater than $600 in any one year.

Scholarships. Concern was expressed in last year's report over the increasing volume of freshman scholarship applications. For the second year in succession an increment of 500 was experienced during 1953–54. This year a total of about 2,000 (double that of two years ago) forms were filed, reviewed and considered. No attempt will be made to assay the complex reasons for this phenomenon of increasing applications, but without question the publicity given to the Sloan National Scholarships by the Sloan Foundation, as well as by ourselves, was a most effective stimulant. There is substantial evidence of a real national interest in M.I.T., all of which underscores our continuing need for an increased number of grants on a national basis for top-flight young men.

By vote of approval of the Student Aid Committee, the Institute is joining with many other colleges and universities in the College Scholarship Service under the aegis of the College Entrance Examination Board. Beginning with the Class of 1959, this service will centralize on a uniform basis information on the family resources and income of freshman scholarship applicants and evaluation of "need" for assistance. The Director of Student Aid has accepted appointment on the Operations Committee of this Service. In the course of the next few years the College Scholarship Service may do much to reduce the multiple applications for scholarship assistance and eliminate some of the doubtful practice of "buying" students.

It should be pointed out that this year's high total of scholarship grants was made possible by supplementing the endowment income, which furnished only approximately one-half of the money granted. One-quarter came from outside gifts and the remaining quarter from our accumulated surplus. By the close of the academic year 1954–55 it is anticipated that our surplus will not be sufficient to furnish this supplementary support to our annual scholarship budget. Therefore, our fund problem is acute and urgently needs solution.

It is a pleasure to record that the Kennecott Copper Corporation has established a senior scholarship in Course xv carrying a stipend of $1,000. Holmes and Narver, Inc. of Los Angeles, California, have donated $10,000 for scholarships in the engineering fields for undergraduates from southern California. Contributions of $70,679 to our current scholarship funds were made by nine companies, seventeen foundations, ten individuals and three alumni clubs. Two grants were made for the first time from the Mead Fund to two undergraduate students in aeronautical engineering, totaling $2,150. Since this is a very special fund it has not been included in the general statistics. A summary of scholarship awards and grants from the Technology Loan Fund for the year is given in the following table:

SCHOLARSHIP AWARDS AND LOAN FUND GRANTS

	1953–54			1952–53		
	Number	*Award*	*Total*	*Number*	*Award*	*Total*
From M.I.T. Endowment Fund:						
Freshman scholarships	187	$98,550		283	$124,040	
Other undergraduate scholarships	309	122,876	$221,426	274	96,155	$220,195
From outside sources:						
Freshman scholarships	30	23,975				
Other undergraduate scholarships	72	46,704	70,679	79	45,795	45,795
	598		$292,105	636		$265,990
Undergraduate loans	392		253,624	283		167,540.18
	*990		$545,729	*819		$433,530.18

* Allowing for individuals receiving both scholarships and loans.

The Loan Fund received 596 applications from both graduate and undergraduate students during 1953–54 and acted favorably on 531 or 89.1 per cent, lending $326,312. For 1952–53 the corresponding figures were 437, 390, 91.3 per cent and $217,266.78.

Veteran Enrollment. The number of students who are veterans of the armed services and received government benefits during the year under Public Laws 16, 346 and 550 is listed as a matter of record:

ENROLLMENT OF VETERANS, 1953–54

	P.L. 16 or 346	P.L. 550	Total	Per cent of Total Registration
Fall Term	154	139	293	5.7%
Spring Term	137	160	297	6.1%
Summer Term	32	80	102	7.0%

Mr. Richard W. Willard '51, who has served very effectively as Assistant to the Director for the past two years, resigned as of June 30 in order to complete his advanced studies at Harvard University.

THOMAS P. PITRÉ

Director of Athletics

Student participation in the organized sports activities, both intramural and intercollegiate, has become somewhat stabilized during the past two years. The obvious and quite normal reason for reaching this level is that the athletic program is reaching a point where a majority of the athletic and recreational needs and interests of the students are being met according to available facilities and time. This lends an encouraging note in that efforts may now be directed toward refinement of the program, facilities and staff. During the past year close to 1,000 students competed in 350 contests in 18 intercollegiate sports. Approximately 1,200 more students participated in the eleven-sport intramural program.

No significant changes or additions to the staff occurred during the past year. Nine full-time coach-instructors and fourteen part-time coaches provided exceptional professional leadership to the 43 varsity, junior varsity and freshman intercollegiate teams and athletic classes. Contrary to the rapid turnover of coaches in some colleges fostering the more conventional types of athletic programs, it is noteworthy that two of the Institute athletic staff

members have served more than thirty years, three for more than twenty years, two for fifteen years and five for five years or more.

The overall percentage of team victories for the year ran approximately 38 per cent. Naturally, some teams enjoyed outstanding success. The varsity track team and cross-country team were undefeated in dual meet competition, and both teams placed third among 23 New England colleges in championship competition. The varsity squash team finished the season with the best record in six years, winning six matches while losing four. The varsity basketball team, after a slow start, won eight out of the last nine games. The varsity lacrosse team won five and lost four games.

The really outstanding records were established by the sailing team and the varsity lightweight crew. The varsity sailing team won the National Collegiate Championships in California. The varsity lightweight crew won the National Collegiate 150-pound Regatta among nine colleges at Princeton, and then went on to climax their season by winning the Thames Challenge Cup at the Henley Royal Regatta in Henley-on-Thames, England.

The Athletic Administrative Board, in conjunction with the Athletic Association, concerted their efforts in a re-evaluation of the athletic program. As a result of these very effective meetings, certain recommendations will be made for redefining and clarifying student responsibilities in the administration of athletics; these point toward preserving and solidifying the philosophy, principles and policies of student participation in running their own affairs.

The required athletic program was revised in order to meet changing conditions. Rather than holding all freshmen to complete the basic requirements during the first year, considerable adjustment was made to permit students greater flexibility to engage in one or more activities of their choice over a period of three years. First-year statistics appear encouraging, in that more than 50 per cent of the freshmen completed their requirements and another 35 per cent have completed half of the requirements. The coaches and instructors report improvement in morale of class and squad members and anticipate opportunities for greater individual and team successes in the future.

IVAN J. GEIGER

Director of the Summer Session

The 1954 Summer Session, the sixth since the reformulation of the Institute's objectives regarding its summer activities, still further improved and extended the pattern which has proved so popular and successful in recent years. It continued to comprise three distinct types of activities: (1) a series of Special Summer Programs primarily directed toward professional adults not otherwise connected with the Institute; (2) professional Conferences on specialized topics; and (3) a program of regular subjects for Institute graduate and undergraduate students desiring to make academic progress during the summer period.

Special Summer Programs. During the 1954 Summer Session 35 different Special Summer Programs were carried out in 13 different departments as follows: Civil Engineering 1, Mechanical Engineering 10, Metallurgy 4, Architecture and City Planning 2, Chemistry 4, Electrical Engineering 5, Physics 3, Economics and Social Science 1, Industrial Management 1, Aeronautical Engineering 1, Mathematics 1, Meteorology 1 and Food Technology 1. This group of 35 Programs (nine more than last year and 13 more than in 1952) represented a substantial diversification of professional interest. Of the 35 topics, 13 had never previously been offered, two had not appeared for several years while 20 constituted re-presentations, because of insistent popular demand, of topics offered last year. The duration of these Programs was from one to six weeks, the majority (22), however, occupying the two-week period shown by experience to be most suited to both registrants and staff.

The number of actual applications for these Programs was 1,865 (far exceeding last year's final total of 1,640). Although, because of lack of space and facilities in certain topics, 132 applications were regretfully declined and despite some inevitable cancellations (223) due to changed personal plans, the actual Special Summer Program attendance was 1,510, approaching for the first time the number of summer registrants in regular Institute subjects (1,671).

Final figures on gross income from the Special Summer Program are presented as follows:

	Tuition	*Housing*	*Total gross income from Special Programs*
1954 Summer Session			
35 Programs, 1,510 registrants.....	$229,020	$46,385	$275,405
1953 Summer Session			
26 Programs, 1,354 registrants.....	197,372	40,335	237,707
1952 Summer Session			
22 Programs, 889 registrants.....	85,507	21,238	106,745

Certain additional comments regarding Special Summer Programs are of interest. In order to facilitate comparison with last year's report, the following figures are submitted in the same form as they were then.

The 1,510 registrants in the 35 Special Summer Programs came primarily from industrial companies (902 = 59.7%), the remainder being drawn from government (454 = 30.1%) or from other research-educational institutions (154 = 10.2%). These 1,510 registrants comprised 1,470 (97.2%) men and 40 (2.7%) women. They came not only from 42 out of the 49 recognized geographical divisions of the United States but also included 87 representatives of other areas as follows: Brazil 3, Canada 58, Canal Zone 3, Chile 1, England 1, France 3, Holland 2, Japan 4, Jugoslavia 3, Puerto Rico 5, Saudi Arabia 1, Spain 2 and West Indies 1. Of the 1,423 from the continental United States, 254 (17.9%) came from New England, 939 (66.0%) others from east of the Mississippi River, 137 (9.6%) from the Central and Mountain areas, and 93 (6.5%) from the Pacific Coast.

While the professional experience of the 1,510 registrants cannot readily be measured, the extent of their previous academic training is suggested by their degrees. Of the total group, 169 (11.2%) held no college degree, although many of these had some college training; 800 (53.0%) held at least one Bachelor's degree; 401 others (26.6%) also held Master's degrees, while 140 additional registrants (9.2%) *also* held Doctor's degrees.

The average age of the total 1,510 registrants was 34.8 years. The oldest individual was 72, the youngest 20. Registrants below the age of 25 numbered 56; those 50 or above numbered 70. The youngest age average for any single Program was 31.2 for Modern Developments in Heat Transfer. The oldest was 41.0 for Organizational Communication.

Of the above total of 1,510 registrants, 1,155 (76.6%) occupied M.I.T. housing while the remaining 355 (23.4%) elected to live elsewhere. Responsive to special efforts to promote the vacation and recreational aspects incidental to their presence in New England, 240 wives (corresponding to 15.9% of total registrants) accompanied their husbands; and of these, 159 (corresponding to 10.5% of total registrants) lived in M.I.T. dormitories.

Conferences. Two Conferences were held during the 1954 Summer Session. The first, on Thin Concrete Shells on June 21, 22 and 23, attracted 238 registrants. The second, on Fire Protection Engineering on August 17, 18 and 19, had a registration of 229.

Regular Institute Subjects. Concurrent with the series of Special Summer Programs and Conferences, a program of regular M.I.T. subjects was offered to graduate and undergraduate students. Although the number of such subjects has been sharply diminished during the last two years, this appears to have had practically no effect upon the number of persons registered, as shown by the following official count at the end of the first week of the Summer Session:

	1951	1952	1953	1954
Graduate registration	938	872	919	857
Undergraduate registration	923	817	660	689
Total	1,961	1,689	1,579	1,546
Number of subjects offered	235	235	179	115

Since during the course of the summer the initial registration always increases slightly, a subsequent count taken during the next-to-the-last week of the 1954 Summer Session showed a total of 1,671 persons registered (according to their Spring 1954 status) as follows: graduate 949; undergraduate 722 (comprising first year 96, second year 304, third year 94 and fourth year 94).

These subjects include those offered by the Nova Scotia Centre for Geological Sciences; but the M.I.T. Surveying Camp at East Machias, Maine, was discontinued. The Foreign Student Summer Project, sponsored and administered by an undergraduate student committee, also operated in 1954 concurrently with but independently of the other summer activities.

The rapid and vigorous development of the Summer Session over the last several years has raised it from an incidental activity to an important element in Institute affairs. It will, nevertheless, endeavor to avoid indefinite multiplication of its sequences of Special Programs and Conferences, rather maintaining an appropriate balance with respect to the threefold character of its clientele; the timeliness, professional distribution and variety of its offerings; and the effective utilization of Institute staff and facilities.

ERNEST H. HUNTRESS

Director of Admissions

This report, following the precedent of other years, covers the twelve-month period ending with the opening of the new academic year in September, 1954, which date marks the natural termination of the Admissions Office year.

The following table compares, for this year and last, applications for admission to the freshman year and those for transfer from other colleges at the undergraduate level:

FIRST YEAR CLASS*	*September, 1953*	*September, 1954*
Total applications	3,954	5,060
Admissions granted	1,565	2,011
Actual registration	843	994
Registration as per cent of admissions	53.9%	49.5%
Number of secondary schools represented	646	678

* Exclusive of former students returning, but including college transfers entering the first year.

COLLEGE TRANSFERS	*September, 1953*	*September, 1954*
Total applications	644	676
Preliminary applications not followed up	270	231
Admissions granted	248	265
Actual registration	185	181
Combined Plan of Study (included in above)	33	23
Registration as per cent of admissions	74.3%	68.3%

In the ten years since the end of World War II, applicants for admission have increasingly adopted the practice of applying simultaneously at several colleges. As a consequence

M.I.T., in common with most other institutions, has experienced an increasing rate of cancellations and a declining "yield" in actual freshman registrations from a given number of acceptances granted. The following table shows the growth and fluctuations in cancellations after admission; this is the group entering from secondary schools only, and excludes first-year college transfers and former students returning:

	PER CENT OF CANCELLATION		
1945	17.5 per cent	1950	37.0 per cent
1946	18.5	1951	40.0
1947	25.0	1952	34.4
1948	27.0	1953	46.1
1949	32.2	1954	50.5

An informal questionnaire circulated last winter brought replies from 58 colleges and universities, indicating that the average shrinkage in 1953 was 35 per cent. It would seem that ours is higher than the average; in part this is because the growing prestige of the Institute attracts applications from many students who find or believe, when the final decision has to be made, that they cannot finance a course here with the amount of aid that has been offered, or that a more favorable offer of financial aid elsewhere warrants acceptance. While the imposition of an application fee is frequently suggested as a remedy, there is reason to believe that this device would effect no more than a moderate decrease in the number of casual applications while tending to discourage worthy applicants of limited means. Our reluctance to impose an application fee is reinforced by the fact that all applicants already must pay the College Board test fee of $12.

The long-range remedy for high cancellation rates is better guidance at the secondary school level, and this will take effect very slowly at best. Meanwhile we, in company with other leading institutions, must accept the heavy load of reviewing and judging an increasing excess of applications relative to the number of freshmen who actually enter. This tendency reflects the basic principle that an admissions office, particularly in a large, independent institution, necessarily devotes the major part of its time and effort to students who eventually go elsewhere. The admissions function thus comes to be increasingly a type of guidance operation which contributes to the general educational welfare;

it goes considerably beyond the narrower purpose of recruiting or selecting in the sole interest of a particular institution.

The rapidly increasing load thrown on the Admissions Office by these conditions has meanwhile to be carried. A part of the increase can and should be met by broader Faculty participation in admissions functions, and this has already been done by the Faculty school-visiting program, now entering its third year. A similar increase in Faculty participation in the reviewing of individual applications may be expected to bring more widespread awareness of some of the critical current problems in the transition from secondary school to college.

The following members of the Faculty and instructing staff, in addition to the Admissions Office staff, have participated in the high-school-visiting program in 1953–54: Professors Holt Ashley, John R. Coleman, William H. Dennen, Leslie H. Fishel, Jr., James G. Kelso, William V. A. Clark, Warren M. Rohsenow, Maurice E. Shank, J. Lowen Shearer, Robert R. Shrock, Howard Simpson and Theodore Wood, Jr.; and from the administration, Dean E. Francis Bowditch, Dean Thomas P. Pitré, Mr. Henry B. Kane and Mr. Philip A. Stoddard.

While the program was somewhat reduced from the level of the previous year, visits were nevertheless made by 20 Institute representatives to 405 secondary schools. They talked with a total of 3,903 students either individually or in small groups averaging about 10.

Alumni representatives, as members of the Educational Council, attended "college conferences" at some 80 high schools where they talked with a total of 1,034 students. Alumni assistance is particularly welcome at these events, since it is not practicable to send representatives directly from M.I.T. to more than a small fraction of the total. In all, therefore, a total of 4,937 students had the opportunity to talk with an M.I.T. representative at their schools, and to receive counsel about the professional fields here represented.

In addition, the Admissions Office last year referred 4,154 students to alumni members of the Educational Council near the students' homes; of these 1,895 had a serious enough interest in making application to look up a member of the Council for a personal conference, with a resulting report submitted by the coun-

sellor to the Admissions Office. Of these students 497 actually entered the freshman class. Most of the remaining freshman entrants were interviewed at the Institute.

The Faculty at its December meeting approved the recommendations of the *School and College Study on Admission with Advanced Standing*. This is an organization of 12 colleges and universities including M.I.T. which, under a grant from the Fund for the Advancement of Education, has encouraged a small number of secondary schools to offer studies of college freshman grade in various subjects so that exceptionally able students could be stimulated and challenged and move ahead correspondingly faster on reaching college. We shall be giving advanced credit as seems appropriate to a number of these exceptional students, based on examinations given at their schools in May of their senior year. This pioneer plan will, it is hoped, be widely imitated by many other strong secondary schools, so as to enable exceptional students to accomplish much more in their school and college years by releasing them to some extent from the "lock-step" of graded year-by-year progress.

On July 1 Mr. Bruce Kingsbury, after three years of effective service in the Admissions Office, became Executive Secretary of the Educational Council and has been succeeded by Mr. Eugene R. Chamberlain.

B. ALDEN THRESHER

Registrar

The registration statistics for 1953–54 and the summary statistics for the preceding years follow. All figures on registration and staff are given as of the fifth week of each fall term, except: 1943–44 as of August 2, 1943, 1944–45 as of November 27, 1944, and 1945–46 as of July 30, 1945.

TABLE 1. Registration of Students Since the Foundation of the Institute*

Year	Number of Students	Year	Number of Students	Year	Number of Students
1865–66	72	1895–96	1,187	1925–26	2,813
1866–67	137	1896–97	1,198	1926–27	2,671
1867–68	167	1897–98	1,198	1927–28	2,712
1868–69	172	1898–99	1,171	1928–29	2,868
1869–70	206	1899–00	1,178	1929–30	3,066
1870–71	224	1900–01	1,277	1930–31	3,209
1871–72	261	1901–02	1,415	1931–32	3,188
1872–73	348	1902–03	1,608	1932–33	2,831
1873–74	276	1903–04	1,528	1933–34	2,606
1874–75	248	1904–05	1,561	1934–35	2,507
1875–76	255	1905–06	1,466	1935–36	2,540
1876–77	215	1906–07	1,397	1936–37	2,793
1877–78	194	1907–08	1,415	1937–38	2,966
1878–79	188	1908–09	1,461	1938–39	3,093
1879–80	203	1909–10	1,479	1939–40	3,100
1880–81	253	1910–11	1,506	1940–41	3,138
1881–82	302	1911–12	1,559	1941–42	3,055
1882–83	368	1912–13	1,611	1942–43	3,048
1883–84	443	1913–14	1,685	1943–44	1,579
1884–85	579	1914–15	1,816	1944–45	1,198
1885–86	609	1915–16	1,900	1945–46	1,538
1886–87	637	1916–17	1,957	1946–47	5,172
1887–88	720	1917–18	1,698	1947–48	5,662
1888–89	827	1918–19	1,819	1948–49	5,433
1889–90	909	1919–20	3,078	1949–50	5,458
1890–91	937	1920–21	3,436	1950–51	5,171
1891–92	1,011	1921–22	3,505	1951–52	4,874
1892–93	1,060	1922–23	3,180	1952–53	5,074
1893–94	1,157	1923–24	2,949	1953–54	5,183
1894–95	1,183	1924–25	2,938		

* From 1943–46 Army and Navy Students omitted. See Table 3-B in reports for 1943–46.

TABLE 2. The Corps of Instructors

	'41	'42	'43	'44	'45	'46	'47	'48	'49	'50	'51	'52	'53
Faculty Members of the Staff	292	313	319	317	330	379	398	413	435	436	457	480	503
Professors	95	97	97	107	113	110	118	124	131	132	136	144	152
Associate Professors	99	104	108	105	103	128	131	131	141	137	144	149	157
Assistant Professors	86	98	99	92	101	125	137	133	138	144	154	166	170
Ex-Officio	7	8	9	10	10	11	11	10	10	8	11	10	12
Professors Emeriti (Lecturers)	—	—	—	—	—	—	—	14	13	13	10	9	10
Instructors	2	3	3	—	—	—	—	—	—	—	—	—	—
Technical Instructors	1	1	1	1	1	1	—	—	—	—	—	—	—
Research Associates	2	2	2	2	2	2	—	—	2	2	2	2	2
Library Fellows	—	—	—	—	—	2	1	1	—	—	—	—	—
Other Members of the Staff	395	370	306	222	252	694	846	824	861	940	999	1051	1092
Instructors	101	100	97	70	82	119	154	142	151	145	139	141	144
Technical Instructors	6	7	8	6	8	14	17	15	15	13	12	13	12
Administrative Assistants	—	—	—	—	—	1	—	—	—	2	2	2	2
Teaching Assistants	—	—	1	—	—	—	—	—	—	—	186	208	222
Teaching Fellows	52	60	52	8	18	74	77	72	91	98	—	—	—
Fellows in Applied Math.	—	—	—	—	—	4	3	—	—	—	—	—	—
Assistants	87	75	49	44	47	127	137	116	124	122	—	—	—
Consultant	—	—	—	—	—	—	—	—	1	—	—	—	—
Lecturers	17	18	16	7	7	11	10	13	11	22	32	25	25
Research Consultant	—	—	1	—	—	—	—	—	—	—	—	—	—
Research Associates	47	34	23	33	39	151	176	155	120	105	86	100	97
Research Assistants	84	64	59	54	51	193	272	311	348	433	474	517	542
Technical Assistants	—	—	—	—	—	—	—	—	—	—	46	45	48
Research Fellows	—	—	—	—	—	—	—	—	—	—	—	—	—
National Research Council Fellows	1	—	—	—	—	—	—	—	—	—	—	—	—
Carnegie Fellows	—	—	—	—	—	—	—	—	—	—	2	—	—
Fellows	—	—	—	—	—	—	—	—	—	—	20	—	—
Staff Members (D.I.C.)	—	12	—	—	—	—	—	—	—	—	—	—	—
Total	687	683	625	539	582	1073	1244	1237	1296	1376	1456	1531	1595
Other Members of the Faculty	37	40	39	44	52	60	67	50	50	54	55	53	58
Faculty and Administrative Officers: Emeriti (not Lecturers)*	36	39	38	43	51	59	66	49	49	53	54	52	57
Non-Resident Professor	1	1	1	1	1	1	1	1	1	1	1	1	1

*Beginning 1948–49.

TABLE 3. Classification of Students by Courses and Years

COURSE NAME AND NUMBER	1951–52 YEAR						1952–53 YEAR						1953–54 YEAR					
	1	2	3	4	G	Total	1	2	3	4	G	Total	1	2	3	4	G	Total
Aeronautical Engineering XVI	37	31	17	19	105	209	59	31	21	19	135	265	61	55	29	20	140	305
Aeronautical Engineering (Coöperative) XVI-B	—	—	19	18	—	37	—	—	4	21	—	25	—	—	8	5	—	13
Architecture IV-A	18	37	34	29	24	142	43	19	42	29	28	161	18	40	26	33	29	146
Architecture (IV-A) Fifth Year	—	—	—	37	—	37	—	—	—	32	—	32	—	—	—	26	—	26
Biology																		
Quantitative VII	12	22	10	10	32	86	15	10	17	6	34	82	7	26	11	8	41	93
Physical VII-A	—	—	—	1	—	1	—	—	—	3	1	4	—	—	—	—	1	1
Chemical VII-B	—	—	—	2	3	5	—	—	—	1	2	3	—	—	—	2	1	3
Building Engineering and Construction XVII	10	12	23	31	18	94	8	10	16	19	23	76	10	15	12	13	19	69
Business and Engineering Administration XV	46	75	68	98	—	287	44	69	96	78	—	287	43	81	81	101	—	306
Industrial Management	—	—	—	—	37	37	—	—	—	—	52	52	—	—	—	—	98	98
Chemical Engineering X	118	76	81	67	110	452	161	89	75	63	106	494	125	126	78	64	123	516
Chemical Engineering Practice X-A, X-B	—	—	—	11	19	30	—	—	—	10	18	28	—	—	—	12	25	37
Chemistry V	29	23	26	31	149	258	37	17	21	23	168	266	23	23	15	21	155	237
City Planning IV-B	—	1	1	2	22	26	—	—	1	1	24	26	—	—	—	2	22	24
Civil Engineering I	60	43	59	56	51	269	69	41	45	55	63	273	59	51	46	47	67	270
Army Engineer (in Civil Eng. Department)	—	—	—	—	4	4	—	—	—	—	6	6	—	—	—	—	7	7
Economics and Engineering XIV	1	6	10	25	50	92	2	8	9	10	54	83	4	10	6	13	44	77
Electrical Engineering VI	153	129	100	103	285	770	178	150	75	86	349	838	183	169	105	79	347	883
Electrical Engineering (Coöperative) VI-A	—	—	43	51	44	138	—	—	46	51	42	139	—	—	41	53	34	128
Food Technology																		
Food Technology XX, XX-A	2	9	8	7	16	42	5	4	4	4	26	43	3	7	2	4	30	46
Biochemical Engineering XX-B	—	—	—	1	—	1	—	—	2	1	—	3	—	—	2	—	—	2
General Engineering IX-B	7	6	12	15	—	40	5	6	16	22	—	49	3	8	13	29	—	53
General Science IX-A	7	—	5	8	—	20	4	3	4	10	—	21	3	2	3	4	—	12
‡Geology XII-A	5	10	18	18	31	82	2	9	8	7	}35	82	4	7	10	8	25	54
Geophysics XII-B	—	—	—	—	—	—	1	7	3	10			—	15	6	3	24	48
Marine Transportation XIII-C	2	1	3	8	—	14	—	—	—	2	—	2	—	—	—	—	—	—
*Marine Transportation (XIII-C) Fifth Year	—	—	—	4	—	4	—	—	—	—	—	—	—	—	—	—	—	—
Mathematics XVIII	12	13	17	26	79	147	23	13	9	18	85	148	22	22	12	15	77	148
Mechanical Engineering II	85	100	70	91	124	470	137	103	74	75	161	550	119	144	80	82	150	575
Mechanical Engineering (Coöperative) II-B	—	—	25	31	—	56	—	—	18	25	—	43	—	—	10	17	—	27
Metallurgy III	13	25	32	42	91	203	17	28	28	30	102	205	17	24	29	32	112	214
Ceramics (in Metallurgy Department)	—	—	—	—	15	15	—	—	—	—	15	15	—	—	—	—	14	14
Meteorology XIX	6	6	8	11	84	115	1	3	6	9	74	93	1	1	1	8	60	71
Naval Architecture and Marine Eng. XIII	18	14	12	16	7	67	19	18	15	9	7	68	10	20	16	17	13	76
Naval Construction and Engineering XIII-A	—	—	—	—	86	86	—	—	—	—	80	80	—	—	—	—	89	89
Physics VIII	95	72	62	72	213	514	105	69	60	60	211	505	117	70	61	53	184	485
Sanitary Engineering XI	—	—	—	—	21	21	—	—	—	—	20	20	—	—	—	—	23	23
Science Teaching IX-C	—	—	3	—	—	3	2	1	2	2	—	7	1	3	1	—	2	7
Total	736	711	766	941*	1,720	4,874	937	708	717	791*	1,921	5,074	833	919	704	771*	1,956	5,183

* These totals include fifth year in Architecture IV-A and Marine Transportation XIII-C (discontinued June 1952).

‡ Beginning 1952–53 Geology became Geology XII-A and Geophysics XII-B.

TABLE 4-A. Classification of Students by Courses, Options and Years

COURSE No.	Name	Option	Opt.	YEAR 1 Opt.	1 Tot.	2 Opt.	2 Tot.	3 Opt.	3 Tot.	4 Opt.	4 Tot.	G Opt.	G Tot.	Total	Course Number
I	Civil Engineering	1. Theory and Design	1	—	59	—	51	21	46	22	47	67	74	277	I
		2. Planning and Administration	2	—		—		1		3					
		3. Construction and Management	3	—		—		24		22					
	Army Engineer			—		—		—		—		7			
II	Mechanical Engineering			—	119	—	144	—	80	—	82	139	150	575	II
	Textile Technology			—		—		—		—		11			
II-B	Mechanical Engineering (Coöperative)	a. At Plant	a	—	—	—	—	3	10	—	17	—	—	27	II-B
		b. At M. I. T.	b	—		—		7		—		—			
III	Metallurgy	1. Metallurgy	1	—	17	—	24	27	29	26	32	102	126	228	III
		2. Mineral Engineering	2	—		—		2		6		10			
	Ceramics			—		—		—		—		14			
IV-A	Architecture			—	18	—	40	—	26	33	59	—	29	172	IV-A
	Fifth Year			—		—		—		26		—			
IV-B	City Planning			—	—	—	—	—	—	—	2	—	22	24	IV-B
V	Chemistry			—	23	—	23	—	15	—	21	—	155	237	V
VI	Electrical Engineering	1. Electric Power	1	—	183	—	169	45	105	12	79	—	347	883	VI
		3. Electrical Communications	3	—		—		25		37		—			
		4. Electronic Applications	4	—		—		35		30		—			
VI-A	Electrical Engineering (Coöperative)	1. Electric Power	1	—	—	—	—	13	41	8	53	—	34	128	VI-A
		3. Electrical Communications	3	—		—		13		28		—			
		4. Electronic Applications	4	—		—		15		17		—			
VII	Quantitative Biology			—	7	—	26	—	11	—	8	—	41	93	VII
VII-A	Physical Biology			—	—	—	—	—	—	—	—	—	1	1	VII-A
VII-B	Chemical Biology			—	—	—	—	—	—	—	2	—	1	3	VII-B
VIII	Physics			—	117	—	70	—	61	—	53	—	184	485	VIII
IX-A	General Science			—	3	—	2	—	3	—	4	—	—	12	IX-A
IX-B	General Engineering			—	3	—	8	—	13	—	29	—	—	53	IX-B
IX-C	Science Teaching			—	1	—	3	—	1	—	—	—	2	7	IX-C
X	Chemical Engineering			—	125	—	126	—	78	—	64	—	123	516	X
X-A	Chemical Engineering Practice — Graduate			—	—	—	—	—	—	—	—	—	25	25	X-A
X-B	Chemical Engineering Practice — Undergraduate			—	—	—	—	—	—	—	12	—	—	12	X-B
XI	Sanitary Engineering			—	—	—	—	—	—	—	—	—	23	23	XI
XII-A	Geology			—	4	—	7	—	10	—	8	—	25	54	XII-A
XII-B	Geophysics			—	—	—	15	—	6	—	3	—	24	48	XII-B
XIII	Naval Architecture and Marine Engineering			—	10	—	20	—	16	—	17	—	13	76	XIII
*XIII-A	Naval Construction and Engineering			—	—	—	—	—	—	—	—	—	89	89	*XIII-A
XIV	Economics and Engineering	A. Mechanical Engineering	A	4	4	3	10	2	6	4	13	—	44	77	XIV
		B. Electrical Engineering	B	—		3		1		7		—			
		C. Chemical Engineering	C	—		4		3		2		—			
XV	Business and Engineering Administration	A. Physical Sciences	A	33	43	63	81	61	81	82	101	—	98	404	XV
		B. Chemical Sciences	B	10		18		20		19		98			
	Industrial Management			—		—		—		—					
XVI	Aeronautical Engineering			—	61	—	55	—	29	—	20	—	140	305	XVI
XVI-B	Aeronautical Engineering (Coöperative)	a. At Plant	a	—	—	—	—	7	8	—	5	—	—	13	XVI-B
		b. At M. I. T.	b	—		—		1		—		—			
XVII	Building Engineering and Construction			—	10	—	15	—	12	—	13	—	19	69	XVII
XVIII	Mathematics			—	22	—	22	—	12	—	15	—	77	148	XVIII
XIX	Meteorology			—	1	—	1	—	1	—	8	—	60	71	XIX
XX	Food Technology			—	3	—	7	—	2	—	3	—	28	43	XX
XX-A	Food Technology			—	—	—	—	—	—	—	1	—	2	3	XX-A
XX-B	Biochemical Engineering			—	—	—	—	—	2	—	—	—	—	2	XX-B
	Total				833		919		704		**771		1956	5183	Total

* First Graduate Year, 44. Second Graduate Year, 26. Third Graduate Year, 20.

** This total includes fifth year [illegible]

TABLE 4-B

CLASSIFICATION OF SPECIAL STUDENTS BY COURSES AND YEARS
(Included in Table 4-A)

COURSE	YEAR					TOTAL	COURSE
	1	2	3	4	G		
I Civil Engineering	—	1	—	1	6	8	I
II Mechanical Engineering	—	1	—	3	18	22	II
III Metallurgy	—	1	4	—	10	15	III
IV-A Architecture	—	—	2	—	5	7	IV-A
IV-B City Planning	—	—	—	1	—	1	IV-B
V Chemistry	—	1	—	—	5	6	V
VI Electrical Engineering	—	1	4	3	115	123	VI
VII Quantitative Biology	1	—	1	—	9	11	VII
VIII Physics	—	1	—	1	17	19	VIII
IX-A General Science	—	—	1	—	—	1	IX-A
IX-B General Engineering	—	1	—	—	—	1	IX-B
X Chemical Engineering	—	—	—	—	5	5	X
XI Sanitary Engineering	—	—	—	—	1	1	XI
XII-A Geology	—	—	—	—	5	5	XII-A
XIII Naval Architecture and Marine Engineering	—	1	—	—	—	1	XIII
XIV Economics and Engineering	—	—	—	—	7	7	XIV
XV Business and Engineering Administration	1	—	—	1	11	13	XV
XVI Aeronautical Engineering	—	—	—	—	39	39	XVI
XVII Building Engineering and Construction	—	—	1	—	—	1	XVII
XVIII Mathematics	—	1	—	1	15	17	XVIII
XIX Meteorology	—	—	—	1	32	33	XIX
XX Food Technology	—	—	—	—	9	9	XX
Total	2	9	13	12	309	345	Total

TABLE 4-C

CLASSIFICATION OF FORMER STUDENTS WHO RETURNED THIS YEAR*
(Included in Table 4-A)

COURSE	YEAR					TOTAL	COURSE
	1	2	3	4	G		
I Civil Engineering	2	1	1	1	2	7	I
II Mechanical Engineering	—	1	2	5	7	15	II
III Metallurgy	—	1	2	4	2	9	III
IV-A Architecture	—	—	2	2	2	6	IV-A
IV-B City Planning	—	—	—	—	1	1	IV-B
V Chemistry	—	—	—	1	1	2	V
VI Electrical Engineering	3	—	7	10	5	25	VI
VII Quantitative Biology	—	—	2	—	1	3	VII
VIII Physics	1	—	7	—	1	9	VIII
IX-A General Science	—	—	—	1	—	1	IX-A
IX-B General Engineering	—	2	1	3	—	6	IX-B
X Chemical Engineering	2	1	3	3	10	19	X
XII-A Geology	—	—	—	—	2	2	XII-A
XII-B Geophysics	—	1	—	—	1	2	XII-B
XIII Naval Architecture and Marine Engineering	—	—	1	1	2	4	XIII
XIII-A Naval Construction and Engineering	—	—	—	—	1	1	XIII-A
XIV Economics and Engineering	—	1	1	3	3	8	XIV
XV Business and Engineering Administration	—	1	5	5	5	16	XV
XVI Aeronautical Engineering	2	—	2	—	2	6	XVI
XVII Building Engineering and Construction	—	—	1	1	2	4	XVII
XVIII Mathematics	—	—	1	1	4	6	XVIII
XIX Meteorology	—	—	—	—	3	3	XIX
Total	10	9	38	41	57	155	Total

* Excludes 57 special students

TABLE 5. Classification of Students by Courses since 1946

	1946–47	1947–48	1948–49	1949–50	1950–51	1951–52	1952–53	1953–54
School of Engineering . . . . . *Total*	4,092	4,398	4,094	4,055	3,287	3,094	3,269	3,370
Aeronautical Engineering XVI, XVI-B	425	346	304	274	276	246	290	318
Building Engineering and Construction XVII	70	98	111	124	116	94	76	69
¶Business and Engineering Administration XV	490	556	449	415	—	—	—	—
Chemical Engineering X, X-A, X-B	695	693	611	596	541	482	522	553
Civil Engineering I	209	220	258	277	277	273	279	277
¶‡Economics and Engineering XIV	4	69	87	81	—	—	—	—
Electrical Engineering VI, VI-A	1,091	1,215	1,051	996	900	908	977	1,011
General Engineering IX-B	32	51	57	62	44	40	49	53
Mechanical Engineering II, II-B	718	749	691	711	617	526	593	602
Metallurgy III	135	155	203	243	231	218	220	228
‡Meteorology XIX	46	46	66	65	71	115	93	71
***Naval Architecture and Marine Eng. XIII, XIII-C . .	85	85	92	92	101	85	70	76
Naval Construction and Engineering XIII-A	78	101	98	98	91	86	80	89
Sanitary Engineering XI	14	14	16	21	22	21	20	23
School of Science . . . . . *Total*	895	1,037	1,090	1,151	1,176	1,159	1,164	1,136
Biology VII, VII-A, VII-B	66	85	77	85	89	92	89	97
Chemistry V	272	292	280	281	272	258	266	237
Food Technology, XX, XX-A, XX-B	29	41	59	46	49	43	46	48
General Science IX-A	3	6	7	10	15	20	21	12
**Geology and Geophysics XII-A, XII-B	27	38	61	86	99	82	82	102
Mathematics XVIII	105	116	137	165	140	147	148	148
Physics VIII	393	459	469	478	512	514	505	485
Science Teaching IX-C	—	—	—	—	—	3	7	7
School of Architecture and Planning . . . . . *Total*	156	179	204	202	224	205	219	196
Architecture IV-A	156	144	169	169	194	179	193	172
*City Planning IV-B	—	35	35	33	30	26	26	24
¶*School of Humanities and Social Studies* . . . . *Total*	—	—	—	—	484	92	83	77
Business and Engineering Administration XV	—	—	—	—	371	—	—	—
Economics and Engineering XIV	—	—	—	—	113	92	83	77
¶*School of Industrial Management* . . . . . *Total*	—	—	—	—	—	324	339	404
Business and Engineering Administration XV	—	—	—	—	—	324	339	404
†Economics and Eng. or Natural Science, Industrial Economics, and Group Psychology . . . . . *Total*	29	48	45	50	—	—	—	—
Grand Total	5,172	5,662	5,433	5,458	5,171	4,874	5,074	5,183

* Prior to February 1947 included in Architecture.
‡ September 1946, Meteorology changed from Course XIV to Course XIX; Economics and Engineering, Course XIV started.
† After June 1950 included in Economics and Engineering XIV.
¶ June 1950, School of Humanities and Social Studies started. Business and Engineering Administration and Economics and Engineering changed from School of Engineering to New School. 1951–52 Business and Engineering Administration changed to School of Industrial Management.
** June 1952, Geology changed to Geology Course XII-A and Geophysics Course XII-B.
*** XIII-C discontinued June 1952.

TABLE 6

GEOGRAPHICAL CLASSIFICATION OF STUDENTS SINCE 1949

UNITED STATES	1949	1950	1951	1952	1953
North Atlantic . . . . . Total	3,590	3,297	3,139	3,276	3,274
Connecticut	199	174	151	150	161
Maine	52	41	40	44	41
Massachusetts	1,672	1,523	1,542	1,547	1,466
New Hampshire	47	45	47	42	39
New Jersey	307	286	270	282	291
New York	973	901	824	939	990
Pennsylvania	267	258	205	199	209
Rhode Island	51	49	38	49	51
Vermont	22	20	22	24	26
South Atlantic . . . . . Total	308	319	262	269	288
Delaware	8	13	11	12	17
District of Columbia	49	44	38	40	45
Florida	65	69	52	62	60
Georgia	10	12	17	17	20
Maryland	61	61	45	43	47
North Carolina	18	20	16	14	23
South Carolina	11	8	8	9	5
Virginia	65	67	55	56	61
West Virginia	21	25	20	16	10
South Central . . . . . Total	200	175	161	148	166
Alabama	25	20	23	15	18
Arkansas	14	11	10	8	5
Kentucky	28	25	23	24	21
Louisiana	20	18	16	14	25
Mississippi	9	12	12	11	7
Tennessee	33	25	25	17	24
Texas	71	64	52	59	66
North Central . . . . . Total	659	633	597	626	665
Illinois	174	151	139	169	175
Indiana	38	41	36	28	30
Iowa	22	11	14	15	18
Kansas	14	17	14	19	23
Michigan	97	94	96	92	95
Minnesota	35	38	35	38	39
Missouri	58	48	47	45	51
Nebraska	28	20	16	18	23
North Dakota	3	2	5	4	4
Ohio	140	158	145	148	154
South Dakota	3	4	5	3	5
Wisconsin	47	49	45	47	48
Western . . . . . Total	290	284	259	272	266
Arizona	7	11	12	14	13
California	99	102	96	109	105
Colorado	28	16	20	18	23
Idaho	8	8	7	6	5
Montana	8	7	9	10	10
Nevada	3	3	2	2	2
New Mexico	7	8	5	9	14
Oklahoma	33	32	28	20	20
Oregon	17	20	20	21	19
Utah	15	14	9	8	9
Washington	58	52	44	49	40
Wyoming	7	11	7	6	6
Territories and Dependencies . . . . Total	26	28	26	19	25
Alaska	4	5	6	2	3
Canal Zone	6	5	4	2	2
Hawaii	12	12	14	12	14
Puerto Rico	4	6	2	3	6
Total for United States	5,073	4,736	4,444	4,610	4,684

(*Continued on following page*)

TABLE 6 — (*Continued*)

GEOGRAPHICAL CLASSIFICATION OF STUDENTS SINCE 1949

FOREIGN COUNTRIES	1949	1950	1951	1952	1953
Total	385	435	430	464	499
Afghanistan	1	—	—	—	1
Argentina	9	8	10	12	15
Australia	2	6	8	8	6
Austria	1	2	3	1	1
Azores	—	—	1	—	—
Bahamas	—	1	—	—	—
Belgium	4	5	1	4	7
Bolivia	2	2	2	1	1
Brazil	13	12	15	10	18
British North Borneo	—	—	—	—	1
British West Indies	3	5	3	2	5
Burma	1	—	1	3	5
Canada	76	80	73	74	74
Canary Islands	—	1	—	—	—
Ceylon	1	—	—	—	—
Chile	1	—	1	2	1
China	21	18	17	16	15
Colombia	6	14	12	13	16
Costa Rica	—	—	1	1	1
Cuba	17	18	17	17	12
Cyprus	1	—	—	—	1
Czechoslovakia	1	1	—	—	—
Denmark	—	1	1	1	—
Dominican Republic	2	—	—	1	2
Ecuador	3	—	2	2	2
Egypt	6	4	5	5	3
England	12	9	14	16	21
Ethiopia	—	—	1	1	1
Finland	2	4	2	3	3
Formosa	—	—	—	—	1
France	15	12	12	13	18
French Indochina	1	—	1	—	—
Germany	—	—	1	2	6
Gold Coast	1	—	—	—	—
Greece	6	12	12	17	22
Guatemala	3	4	4	2	1
Haiti	—	—	—	1	1
Hong Kong	5	11	14	10	1
Hungary	—	1	—	—	—
Iceland	3	3	1	2	2
India	34	34	30	37	43
Iran	—	1	2	2	2
Iraq	5	6	4	2	2
Ireland	—	1	—	1	—
Israel	3	14	19	23	21
Italy	4	7	3	1	5
Jamaica	—	—	1	—	—
Japan	—	1	6	9	10
Kenya	—	1	1	1	—
Korea	1	2	1	—	1
Lebanon	2	1	1	3	2
Luxembourg	1	—	—	—	1
Malaya	2	2	1	1	1
Mauritius	—	—	—	1	1
Mexico	13	15	12	18	21
Morocco	1	—	1	—	—
Mozambique	1	2	1	1	1
Netherlands	1	3	3	2	1
Netherlands East Indies	2	—	—	—	—
Netherlands West Indies	2	2	2	3	1

(*Continued on following page*)

TABLE 6 — (*Continued*)

GEOGRAPHICAL CLASSIFICATION OF STUDENTS SINCE 1949

FOREIGN COUNTRIES	1949	1950	1951	1952	1953
New Zealand	2	3	2	3	2
Nicaragua	2	3	2	3	1
Nigeria	—	1	1	1	3
Norway	31	25	22	13	16
Pakistan	1	3	2	4	4
Panama	—	—	1	2	2
Peru	3	5	7	8	8
Philippines	13	10	14	16	13
Poland	1	1	—	1	—
Portugal	5	4	3	2	—
Salvador	—	—	2	1	3
Scotland	2	3	4	5	2
Singapore	1	3	2	1	1
Spain	2	1	1	3	3
Sweden	3	6	10	9	5
Switzerland	3	2	3	1	3
Syria	—	—	1	2	2
Tanganyika	1	1	1	—	—
Thailand	3	4	3	5	5
Transjordan	—	—	—	1	—
Turkey	5	2	2	5	4
Union of South Africa	4	7	5	2	5
Uruguay	4	7	8	5	4
United States of Indonesia	—	3	—	—	—
Venezuela	7	15	11	25	35
Vietnam	—	—	—	—	1
Yugoslavia	1	—	—	1	—
Grand Total, United States and Foreign	5,458	5,171	4,874	5,074	5,183

TABLE 7

NEW STUDENTS ENTERING FROM OTHER COLLEGES AS CANDIDATES FOR DEGREES

Class Joined at the Institute	Years Spent at College				Total
	One	Two	Three	Four or more	
First Year	12	3	1	2	18
Second Year	31	35	7	19	92
Third Year	—	15	31	23	69
Fourth Year	—	—	1	5	6
Graduate Year	—	—	40	452	492
Total	43	53	80	501	677

TABLE 8. WOMEN STUDENTS CLASSIFIED BY COURSES AND YEARS

Course	1	2	3	4	G	Total
I Civil Engineering	1	1	—	—	—	2
II Mechanical Engineering	—	—	—	—	1	1
Textile Technology	—	—	—	—	1	1
III Metallurgy	—	—	—	—	1	1
IV-A Architecture	3	2	1	1	2	9
Fifth Year	—	—	—	1	—	1
IV-B City Planning	—	—	—	—	1	1
V Chemistry	2	2	2	1	4	11
VI Electrical Engineering	2	—	2	1	—	5
VII Quantitative Biology	—	4	3	—	6	13
VIII Physics	2	3	3	1	6	15
IX-A General Science	1	1	—	1	—	3
IX-B General Engineering	—	1	—	2	—	3
IX-C Science Teaching	—	1	—	—	—	1
X Chemical Engineering	2	—	2	2	1	7
XII-A Geology	—	—	—	—	1	1
XII-B Geophysics	—	—	—	—	1	1
XIV Economics and Engineering	—	—	—	2	3	5
XV Business and Engineering Administration	—	1	—	3	—	4
XVI Aeronautical Engineering	1	—	—	—	1	2
XVIII Mathematics	1	3	1	1	5	11
XIX Meteorology	—	—	—	1	2	3
XX Food Technology	—	—	—	—	2	2
Total	15	19	14	17	38	103

TABLE 9. OLD AND NEW STUDENTS

Year	1948–49	1949–50	1950–51	1951–52	1952–53	1953–54
Students registered at end of last academic year (including specials)	3,663	3,639	3,461	3,251	3,130	3,361
Students who have previously attended the Institute but were not registered at end of last academic year (including specials)	262	189	186	204	214	212
New students who entered by examination	501	433	510	443	605	803
New students who entered without examination	261	241	206	238	304	—
New students who entered from other colleges as candidates for degrees	645	877	732	575	631	677
New students (specials, not candidates for degrees)	101	79	76	163	190	130
Total	5,433	5,458	5,171	4,874	5,074	5,183

TABLE 10. List of American Colleges and Universities with Number of Graduates Attending the Institute

College		College		College	
Adelphi College	1	DePauw University	1	Massachusetts,University of	11
Akron University	1	Drew University	2	Merrimack College	1
Alabama Polytechnic Inst.	4	Drexel Institute of Tech	4	Miami University (Ohio)	5
Alabama, University of	3	Duke University	4	Miami, University of (Fla.).	1
Alfred University	4	Duquesne University	3	Michigan College of Mining and Technology	5
American Television Inst.	2	Eastern Kentucky State College	1	Michigan State College	5
Amherst College	17	Eastern Nazarene College	1	Michigan, University of	30
Antioch College	11	Emmanuel College	4	Middlebury College	8
Arkansas, University of	1	Emory University	1	Milwaukee School of Engineering	1
Assumption College	1	Erskine College	1	Minnesota, University of	11
Babson Institute	1	Evansville College	2	Mississippi State College	2
Bates College	1	Fisk University	2	Missouri School of Mines and Metallurgy	2
Bethany College	1	Fordham University	3	Missouri, University of	2
Birmingham-Southern Coll.	1	Franklin and Marshall Coll.	1	Montana School of Mines	2
Boston College	20	Gannon College	1	Montana State University	1
Boston University	10	Geneva College	1	Nebraska, University of	6
Bowdoin College	3	Georgetown University	1	Nevada, University of	2
Bradley University	1	George Washington Univ.	2	Newark Coll. of Engineering	4
Brandeis University	2	Georgia Institute of Tech.	12	New Hampshire, Univ. of	9
Brigham Young University	2	Gettysburg College	3	New Mexico College of Agric. and Mech. Arts	1
Brooklyn College	7	Hamilton College	3	New Mexico, University of	2
Brown University	17	Harvard University	50	New York University	22
Bryn Mawr College	3	Haverford College	1	Niagara University	2
Bucknell University	4	Holy Cross, College of the	4	North Carolina State Coll.	6
Buffalo, University of	2	Hope College	1	North Carolina, Univ. of	1
Butler University	1	Houston, University of	1	North Dakota Agric. College	2
California Inst. of Tech.	19	Howard University	3	North Dakota State Teachers College	1
California, University of at Berkeley	21	Idaho, University of	2	Northeastern University	37
California, University of at Los Angeles	6	Illinois Inst. of Technology	12	North Texas State College	2
Carleton College	1	Illinois, University of	21	Northwestern University	7
Carnegie Institute of Tech.	8	Institute of Design	1	Norwich University	2
Carson-Newman College	1	Institute of Textile Tech.	1	Notre Dame, University of	6
Case Inst. of Technology	6	Indiana University	4	Oberlin College	6
Catholic University of America	3	Iowa State College	9	Occidental College	2
Central Michigan College of Education	1	Jackson College	1	Ohio State University	5
Chicago, University of	9	Johns Hopkins University	11	Ohio University	3
Cincinnati, University of	11	Juniata College	2	Ohio Wesleyan University	4
Citadel, The	2	Kansas State College of Agric. and Applied Science	6	Oklahoma Agric. and Mech. College	4
City College, The (N.Y.)	31	Kansas, University of	4	Oklahoma, University of	3
Clark University	1	Kent State University	1	Oregon State College	2
Clarkson College of Tech.	2	Kentucky, University of	3	Pacific Union College	1
Clemson College	2	Lafayette College	3	Pembroke College	1
Colby College	1	Lawrence Institute of Tech.	1	Pennsylvania State College.	13
College of New Rochelle	1	Lebanon Valley College	1	Pennsylvania, Univ. of	17
College of Puget Sound	2	Lehigh University	11	Philadelphia Textile Inst.	1
College of Wooster	6	Louisiana State University and Agric.and Mech.Coll.	10	Pittsburgh, University of	4
Colorado Agricultural and Mechanical College	2	Louisville, University of	2	Polytechnic Institute of Brooklyn	10
Colorado School of Mines	3	Lowell Textile Institute	4	Pomona College	2
Colorado State College of Education	2	Loyola University (Ill.)	2	Pratt Institute	2
Colorado, University of	7	Loyola University (La.)	1	Princeton University	13
Columbia College	1	Luther College	1	Principia College	3
Columbia University (N.Y.)	19	Lycoming College	1	Purdue University	24
Connecticut, University of	5	Macalester College	1	Radcliffe College	4
Cooper Union, The	8	Maine, University of	7	Reed College	2
Cornell University	19	Marquette University	6	Regis College	1
Dartmouth College	8	Maryland, University of	1	Rensselaer Polytechnic Inst.	37
Davidson College	1	Massachusetts Institute of Technology	673	Rhode Island School of Design	1
Dayton, University of	3			Rhode Island, University of	2
Delaware, University of	3				
Denison University	1				
Denver, University of	2				

(*Continued on following page*)

TABLE 10. List of American Colleges and Universities with Number of Graduates Attending the Institute (*Continued*)

College		*College*		*College*	
Rice Institute	5	Tennessee Agric. and Ind. State College	2	Washington and Jefferson College	1
Ripon College	7	Texas Agric.and Mech.Coll.	7	Washington, State College of	7
Roanoke College	1	Texas Christian University	1	Washington, University of	9
Rochester, University of	10	Texas Technological College	3	Washington University	8
Rose Polytechnic Institute	2	Texas, University of	10	Wayne University	3
Rutgers University	11	Toledo, University of	4	Webb Inst. of Naval Arch.	3
St. John's College (N.Y.)	1	Trinity College	2	Wellesley College	7
St.John's University(Minn.)	2	Tri-State College	2	Wesleyan University	2
St. Joseph's College	1	Tufts College	19	Western Illinois State Coll.	1
St. Lawrence University	3	Tulane University of Louisiana	5	Western Reserve University	2
St. Louis University	1	Union College (N. Y.)	6	West Virginia, University of	6
San Diego State College	1	Upsala College	1	Whitman College	1
Seminary College of Jewish Study of Jewish Theology	1	U.S. Air Force Inst. of Tech.	1	Willamette University	2
Smith College	2	U.S. Coast Guard Academy	30	William and Mary, Coll. of	2
South Dakota School of Mines and Technology	1	U.S. Merchant Marine Academy	4	Williams College	12
South, University of the	1	U.S. Military Academy	23	Wisconsin, University of	13
Southern California,Univ.of	1	U.S. Naval Academy	76	Worcester Polytechnic Inst.	11
Southern Methodist Univ.	1	U.S. Naval Postgraduate School	15	Wyoming, University of	2
Southwestern Louisiana Inst.	1	Utah, University of	6	Yale University	21
Spring Hill College	1	Valparaiso University	1	Yeshiva College	3
Stanford University	10	Vanderbilt University	3	Total	2072
State University of New York (Maritime)	1	Vassar College	1		
Stevens Inst. of Technology	4	Vermont, University of	2	Number of American Colleges Represented	253
Sul Ross State College	1	Villanova College	2	Number of Foreign Colleges Represented (not listed)	151
Swarthmore College	8	Virginia Military Institute	5	Total	404
Syracuse University	9	Virginia Polytechnic Inst.	5		
Temple University	3	Virginia Union University	1		
Tennessee Polytechnic Inst.	1	Virginia, University of	3		
Tennessee, University of	4				

TABLE 11

Regular Students from Colleges Classified by Courses

COURSE	No Previous Degree			Graduates of Other Colleges					Graduates of M. I. T. Taking Graduate Work		
	Entered			Entered							
				Sept. 1953		Previous Years					
	Sept. 1953	Previous Years	Total	Undergrad.	Grad.	Undergrad.	Grad.	Total	S.B. Degree 1953	Other Graduates	Total
Aeronautical Engineering XVI	11	8	19	—	38	—	34	72	13	16	29
Architecture IV-A	8	14	22	6	16	11	6	39	—	2	2
Biology VII, VII-A, VII-B	—	3	3	—	7	—	18	25	4	5	9
Building Engineering and Construction XVII	4	4	8	—	8	4	6	18	—	5	5
Business and Engineering Administration XV	18	23	41	3	61	6	18	88	2	6	8
Chemical Engineering X, X-A, X-B	8	19	27	—	45	6	49	100	26	23	49
Chemistry V	1	3	4	—	45	—	94	139	—	11	11
City Planning IV-B	—	—	—	—	6	—	13	19	1	2	3
Civil Engineering I	14	18	32	3	29	3	20	55	7	12	19
Economics and Engineering XIV	1	1	2	—	14	1	20	35	1	2	3
Electrical Engineering VI, VI-A	31	59	90	10	65	6	121	202	43	37	80
Food Technology XX, XX-A, XX-B	1	—	1	—	3	—	12	15	2	4	6
General Engineering IX-B	3	9	12	2	—	1	—	3	—	—	—
General Science IX-A	—	1	1	—	—	—	—	—	—	—	—
Geology XII-A	—	—	—	—	2	—	13	15	3	2	5
Geophysics XII-B	—	2	2	—	6	—	4	10	6	8	14
Mathematics XVIII	1	5	6	1	18	—	29	48	3	12	15
Mechanical Engineering II	31	29	60	5	34	5	47	91	19	32	51
Metallurgy III	1	6	7	2	17	—	53	72	13	33	46
Meteorology XIX	—	1	1	—	6	—	14	20	2	6	8
Naval Architecture and Marine Eng. XIII, XIII-C	8	9	17	1	5	1	2	9	2	4	6
Naval Construction and Engineering XIII-A	—	—	—	—	33	—	55	88	—	1	1
Physics VIII	7	12	19	4	26	—	88	118	12	41	53
Sanitary Engineering XI	—	—	—	—	8	—	11	19	3	—	3
Science Teaching IX-C	—	—	—	—	—	—	—	—	2	—	2
Total	148	226	374	37	492	44	727	1,300	164	264	428

TABLE 12. NUMBER OF DEGREES AWARDED IN SEPTEMBER 1953, FEBRUARY 1954, AND JUNE 1954

Name of Course	S.B.			B.Arch.and B.C.P.			S.M.			M.Arch. and M.C.P.			Adv.Eng.			Ph.D.			Sc.D.			Total		
	Sept.	Feb.	June	Sept.	Feb.	June	Sept.	Feb.	June	Sept.	Feb.	June	Sept.	Feb.	June	Sept.	Feb.	June	Sept.	Feb.	June	Sept.	Feb.	June
Aeronautical Engineering	6	1	16	—	—	—	3	2	27	—	—	—	1	1	2	—	—	—	1	—	4	11	4	49
Architecture	—	—	—	5	1	21	—	—	—	11	3	3	—	—	—	—	—	—	—	—	—	16	4	24
Biochemical Engineering	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—
Biology	—	—	—	—	—	—	3	—	2	—	—	—	—	—	—	1	—	3	—	—	—	4	—	5
Building Eng. and Constr.	—	1	10	—	—	—	5	—	2	—	—	—	—	—	2	—	—	—	—	—	—	5	1	14
Business and Eng. Admin.	5	6	77	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	6	77
Ceramics	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	—	—	5	—
Chemical Biology	—	—	1	—	—	—	2	—	1	—	—	—	—	—	—	—	—	—	—	—	—	2	—	2
Chemical Engineering	4	3	52	—	—	—	8	4	17	—	—	—	—	—	1	—	—	—	1	4	2	13	11	72
Chemical Engineering Practice	—	—	13	—	—	—	—	5	18	—	—	—	—	—	—	—	—	—	—	—	—	—	5	31
Chemistry	4	—	16	—	—	—	5	—	1	—	—	—	—	—	—	15	10	5	—	—	—	24	10	22
City Planning	—	—	—	—	1	—	—	—	—	3	2	8	—	—	—	—	—	—	—	—	—	3	3	8
Civil Engineering	3	6	31	—	—	—	8	4	22	—	—	—	1	—	—	—	—	—	1	—	1	13	10	54
Economics and Engineering	2	—	11	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	2	—	12
Electrical Engineering	18	7	81	—	—	—	28	19	46	—	—	—	—	2	3	—	—	—	6	3	4	52	31	134
Food Technology	—	—	4	—	—	—	2	2	4	—	—	—	—	—	—	2	—	1	—	—	—	4	2	9
General Engineering	3	1	18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	1	18
General Science	2	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2
Geology	—	—	8	—	—	—	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	2	9
Geology and Geophysics	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	3	—	—	1	1	2	4
Geophysics	2	—	3	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	2	—	5
Industrial Economics	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	8*	—	—	—	—	1	8
Industrial Management	—	—	—	—	—	—	—	—	59	—	—	—	—	—	—	—	—	—	—	—	—	—	—	59
Marine Engineering	—	—	—	—	—	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	—
Mathematics	1	1	11	—	—	—	1	1	3	—	—	—	—	—	—	1	—	4	—	1	—	3	3	18
Mechanical Engineering	4	8	72	—	—	—	12	11	26	—	—	—	—	3	3	—	—	—	—	3	10	16	25	111
Metallurgy	—	1	27	—	—	—	8	9	6	—	—	—	—	—	3	—	—	—	4	8	7	12	18	43
Meteorology	—	—	7	—	—	—	10	3	7	—	—	—	—	—	—	—	—	—	—	2	1	10	5	15
Naval Architecture	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—
Naval Arch. and Marine Eng.	—	1	14	—	—	—	—	—	4	—	—	—	—	—	29	—	—	—	—	—	—	—	1	47
Nuclear Engineering	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—
Physical Biology	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Physics	4	3	47	—	—	—	7	2	6	—	—	—	—	—	—	4	12	10	—	—	—	15	17	63
Quantitative Biology	4	—	10	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	10
Sanitary Engineering	—	—	—	—	—	—	3	—	6	—	—	—	—	—	1	—	—	—	1	—	2	4	—	9
Textile Technology	—	—	—	—	—	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	1	3
Without Course Classification	—	—	—	—	—	—	6	3	40	—	—	—	—	—	—	—	—	—	—	—	—	6	3	40
Total	64	41	531	5	2	21	120	69	304	14	5	11	2	6	44	24	25	34	14	26	32	243	174	977

* Includes 1 in Psychology.

TABLE 13

Degrees of Bachelor of Science According to Class in Which They Were Awarded

Class (Calendar Year)	Aeronautical Eng.	Architectural Eng.‡	Architecture	Biology or Natural Hist. (Inc. VII-A)	Bldg. Eng. & Constr.	Business and Eng. Admin.	Chemical Eng.	Chemical Eng. Practice X-B	Chemistry	Civil Engineering	Economics and Engineering	Electrical Eng. (Inc. VI-A)	Electrochemical Engineering*	Food Technology	General Eng.	General Science or General Course	Geol. & Geophysics	Mathematics	Mechanical Eng. (Inc. II-A)	Metallurgy**	Meteorology	Military Eng.	Mining Eng. and Metallurgy	Naval Arch. and Marine Eng.	Physics	Sanitary Eng.	Total	Total by Decades
1868	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	1	—	—	1	—	—	—	6	—	—	—	14	
1869	—	—	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	5	
1870	—	—	—	—	—	—	—	—	1	4	—	—	—	—	—	1	—	—	2	—	—	—	2	—	—	—	10	29
1871	—	—	—	—	—	—	—	—	2	8	—	—	—	—	—	—	—	—	2	—	—	—	5	—	—	—	17	
1872	—	—	—	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—	1	—	—	—	5	—	—	—	12	
1873	—	—	1	—	—	—	—	—	7	12	—	—	—	—	—	1	—	—	2	—	—	—	3	—	—	—	26	
1874	—	—	1	—	—	—	—	—	—	10	—	—	—	—	—	2	—	—	4	—	—	—	1	—	—	—	18	
1875	—	—	1	—	—	—	—	—	1	10	—	—	—	—	—	2	—	—	7	—	—	—	6	—	1	—	28	
1876	—	—	1	2	—	—	—	—	5	12	—	—	—	—	—	4	—	—	8	—	—	—	8	—	3	—	43	
1877	—	—	4	—	—	—	—	—	2	12	—	—	—	—	—	—	—	—	6	—	—	—	8	—	—	—	32	
1878	—	—	3	—	—	—	—	—	3	8	—	—	—	—	—	1	—	—	2	—	—	—	2	—	—	—	19	
1879	—	—	1	1	—	—	—	—	3	6	—	—	—	—	—	—	—	—	8	—	—	—	3	—	1	—	23	
1880	—	—	—	—	—	—	—	—	1	3	—	—	—	—	—	1	—	—	—	—	—	—	3	—	—	—	8	226
1881	—	—	3	1	—	—	—	—	8	3	—	—	—	—	—	2	—	—	5	—	—	—	6	—	—	—	28	
1882	—	—	3	1	—	—	—	—	6	2	—	—	—	—	—	1	—	—	5	—	—	—	5	—	1	—	24	
1883	—	—	1	—	—	—	—	—	3	3	—	—	—	—	—	—	—	—	7	—	—	—	5	—	—	—	19	
1884	—	—	—	—	—	—	—	—	12	5	—	—	—	—	—	—	—	—	6	—	—	—	13	—	—	—	36	
1885	—	—	2	—	—	—	—	—	4	4	—	2	—	—	—	1	—	—	7	—	—	—	8	—	—	—	28	
1886	—	—	1	1	—	—	—	—	7	9	—	10	—	—	—	1	—	—	23	—	—	—	7	—	—	—	59	
1887	—	—	1	1	—	—	—	—	9	10	—	8	—	—	—	3	—	—	17	—	—	—	8	—	1	—	58	
1888	—	—	5	3	—	—	—	—	10	11	—	17	—	—	—	1	—	—	25	—	—	—	4	—	1	—	77	
1889	—	—	3	1	—	—	—	—	8	14	—	17	—	—	—	2	—	—	24	—	—	—	5	—	1	—	75	
1890	—	—	5	3	—	—	—	—	13	25	—	18	—	—	—	6	—	—	28	—	—	—	3	—	2	—	103	507
1891	—	—	6	3	—	—	7	—	11	18	—	23	—	—	—	1	1	—	26	—	—	—	4	—	3	—	103	
1892	—	—	13	6	—	—	4	—	7	22	—	36	—	—	—	7	1	—	26	—	—	—	4	—	1	6	133	
1893	—	—	2	2	—	—	8	—	8	25	—	41	—	—	—	6	2	—	30	—	—	—	5	—	—	—	129	
1894	—	—	14	1	—	—	12	—	11	21	—	33	—	—	—	5	—	—	31	—	—	—	4	—	3	3	138	
1895	—	—	15	—	—	—	11	—	14	25	—	33	—	—	—	4	—	—	30	—	—	—	3	5	2	4	146	
1896	—	—	24	3	—	—	7	—	17	26	—	48	—	—	—	7	3	—	34	—	—	—	10	5	3	4	191	
1897	—	—	16	2	—	—	12	—	20	25	—	33	—	—	—	7	1	—	40	—	—	—	7	9	3	4	179	
1898	—	—	29	3	—	—	9	—	25	32	—	33	—	—	—	6	—	—	41	—	—	—	7	7	4	3	199	
1899	—	—	22	2	—	—	10	—	22	30	—	32	—	—	—	1	—	—	37	—	—	—	9	8	2	1	176	
1900	—	—	21	3	—	—	11	—	19	32	—	23	—	—	—	5	—	—	34	—	—	—	21	9	3	4	185	1,579

* Prior to 1909 this Course was designated as Option 3 (Electrochemistry) of Course VIII.
‡ Prior to 1923 degrees were awarded in Architecture.
** Prior to 1938 included in Mining Engineering and Metallurgy.

(*Continued on following page*)

TABLE 13 — (*Continued*)

Degrees of Bachelor of Science According to Class in Which They Were Awarded

Class (Calendar Year)	Aeronautical Eng.	Architectural Eng.‡	Architecture	Biology or Natural Hist. (Inc. VII-A)	Bldg. Eng. & Constr.	Business and Eng. Admin.	Chemical Eng.	Chemical Eng. Practice X-B	Chemistry	Civil Engineering	Economics and Engineering	Electrical Eng. (Inc. VI-A)	Electrochemical Engineering*	Food Technology	General Eng.	General Science or General Course	Geol. & Geophysics	Mathematics	Mechanical Eng. (Inc. II-A)	Metallurgy**	Meteorology	Military Eng.	Mining Eng. and Metallurgy	Naval Arch. and Marine Eng.	Physics	Sanitary Eng.	Total	Total by Decades
1901	—	—	21	1	—	—	14	—	17	37	—	25	—	—	—	6	1	—	39	—	—	—	18	16	1	4	200	
1902	—	—	18	5	—	—	9	—	14	24	—	35	—	—	—	3	—	—	46	—	—	—	14	14	3	7	192	
1903	—	—	15	1	—	—	10	—	13	26	—	39	1	—	—	1	1	—	37	—	—	—	27	12	3	4	190	
1904	—	—	24	3	—	—	7	—	15	34	—	34	8	—	—	5	1	—	45	—	—	—	32	17	5	2	232	
1905	—	—	12	3	—	—	13	—	23	46	—	31	3	—	—	3	1	—	54	—	—	—	26	24	—	5	244	
1906	—	—	22	2	—	—	10	—	21	47	—	37	3	—	—	—	—	—	69	—	—	—	38	19	4	6	278	
1907	—	—	21	—	—	—	14	—	10	37	—	32	5	—	—	—	2	—	52	—	—	—	22	10	—	3	208	
1908	—	—	19	4	—	—	15	—	16	48	—	38	2	—	—	—	—	—	62	—	—	—	19	5	—	2	230	
1909	—	—	18	5	—	—	13	—	12	51	—	42	3	—	—	—	—	—	41	—	—	—	30	5	3	9	232	
1910	—	—	18	3	—	—	18	—	10	57	—	36	3	—	—	2	—	—	57	—	—	—	24	11	—	12	251	2,257
1911	—	—	10	1	—	—	19	—	12	46	—	49	5	—	—	2	—	—	49	—	—	—	17	6	1	15	232	
1912	—	—	21	4	—	—	31	—	7	55	—	52	3	—	—	1	—	—	47	—	—	—	21	3	2	14	261	
1913	—	—	26	2	—	—	30	—	12	58	—	43	8	—	—	—	—	—	50	—	—	—	20	4	1	15	269	
1914	—	—	19	6	—	—	37	—	9	60	—	51	8	—	—	4	—	—	65	—	—	—	17	8	1	19	304	
1915	—	—	30	3	—	—	33	—	23	49	—	42	10	—	—	3	—	—	69	—	—	—	5	7	3	12	289	
1916	—	—	37	5	—	—	32	—	11	45	—	56	14	—	—	2	—	—	84	—	—	—	5	9†	3	18	321	
1917	—	—	27	10	—	37	43	—	13	49	—	45	10	—	—	5	2	—	63	—	—	—	14	9†	1	17	345	
1918	—	—	28	7	—	29	40	—	10	45	—	50	11	—	2	4	1	—	75	—	—	—	10	4	3	5	324	
1919	—	—	16	9	—	28	44	—	8	45	—	50	6	—	3	1	—	—	66	—	—	—	7	7	4	6	300	
1920	—	—	19	2	—	48	63	—	6	52	—	30	9	—	1	4	—	—	55	—	—	—	13	12	2	2	318	2,963
1921	—	—	11	3	—	70	92	—	9	98	—	75	15	—	15	—	3	—	128	—	—	—	24	18	1	3	565	
1922	—	—	32	8	—	126	98	15	11	65	—	109	25	—	25	1	8	—	56	—	—	—	27	16	8	7	637	
1923	—	13	18	6	—	115	73	19	16	64	—	78	16	—	23	2	8	3	106	—	—	—	23	13	9	3	608	
1924	—	6	15	6	—	82	57	8	13	69	—	125	17	—	36	4	2	1	82	—	—	—	19	11	3	1	557	
1925	—	6	18	2	—	94	53	8	18	57	—	110	9	—	37	2	3	2	98	—	—	—	23	10	5	—	555	
1926	—	9	24	5	—	95	45	13	19	76	—	108	14	—	33	2	4	1	76	—	—	—	20	14	1	2	561	
1927	2	15	19	6	—	89	39	6	13	73	—	121	8	—	22	2	3	3	72	—	—	1	9	4	4	3	514	
1928	8	19	16	5	—	73	38	7	13	59	—	114	11	—	12	2	1	3	67	—	—	—	12	3	3	5	471	
1929	29	25	26	7	9	69	37	11	18	46	—	84	10	—	14	1	2	5	64	—	—	—	11	5	4	6	483	
1930	29	15	44	9	23	59	39	12	11	46	—	76	8	—	9	1	2	1	48	—	—	—	6	6	11	4	459	5,410

* Prior to 1909 this Course was designated as Option 3 (Electrochemistry) of Course VIII.
† Two received the degree in Naval Architecture, Course XIII-B, in 1916 and three in 1917.
‡ Prior to 1923 degrees were awarded in Architecture.
** Prior to 1938 included in Mining Engineering and Metallurgy.

(*Continued on following page*)

TABLE 13 — (*Continued*)

Degrees of Bachelor of Science According to Class in Which They Were Awarded

Class (Calendar Year)	Aeronautical Eng.	Architectural Eng.	Architecture	Biology or Natural Hist. (Inc. VII-A)	Bldg. Eng. & Constr.	Business and Eng. Admin.	Chemical Eng.	Chemical Eng. Practice X-B	Chemistry	Civil Engineering	Economics and Engineering	Electrical Eng. (Inc. VI-A)	Electrochemical Engineering	Food Technology	General Eng.	General Science or General Course	Geol. & Geophysics	Mathematics	Mechanical Eng. (Inc. II-A)	Metallurgy**	Meteorology	Military Eng.	Mining Eng. and Metallurgy	Naval Arch. and Marine Eng.	Physics	Sanitary Eng.	Total	Total by Decades
1931	39	10	18	16	15	68	32	10	12	49	—	83	6	—	22	5	3	4	70	—	—	—	12	13	7	2	496	
1932	27	16	5	15	18	70	45	7	15	38	—	74	4	—	29	3	2	3	68	—	—	4	21	16	21	4	505	
1933	27	9	—	13	9	56	38	3	18	47	—	86	8	—	16	3	2	7	86	—	—	—	14	13	14	2	471	
1934	26	10	—	16	13	78	48	6	15	35	—	82	7	—	8	9	1	8	50	—	—	—	26	25	28	5	496	
1935	27	8	—	18	8	74	43	5	15	18	—	57	8	—	19	4	1	3	45	—	—	—	14	14	19	1	401	
1936	27	3	—	13	12	63	31	20	16	23	—	68	5	—	25	6	2	8	47	—	—	—	10	18	11	2	410	
1937	30	3	—	9	4	61	34	9	13	15	—	67	5	—	20	4	—	4	46	—	—	—	19	19	17	1	380	
1938	25	3	—	11	4	56	51	6	14	22	—	62	4	—	28	6	1	2	50	10	—	—	5	23	14	2	399	
1939	30	2	—	6	7	56	53	12	25	23	—	67	7	—	19	13	4	2	72	20	—	—	9	8	17	1	453	
1940	29	—	—	12	9	59	59	12	23	14	—	73	2	—	36	20	6	7	68	22	—	—	7	24	22	—	504	4,515
1941	36	—	—	6	7	59	54	8	28	22	—	79	—	—	23	5	8	6	90	29	—	—	—	18	23	—	501	
1942	39	—	—	17	3	61	60	8	34	16	—	66	—	—	20	11	5	4	98	34	—	—	—	29	25	1	531	
1943	38	—	—	10	5	49	49	14	21	14	—	83	—	—	18	11	2	6	80	24	—	—	—	33	14	1	472	
1944	57	—	—	4	3	28	41	20	12	18	—	47	—	—	14	4	1	2	78	8	—	—	—	37	20	2	396	
1945	22	—	—	1	1	22	36	—	5	9	—	45	—	—	6	1	—	5	70	3	—	—	—	13	16	—	255	
1946	84	—	—	—	5	33	59	—	9	13	—	91	—	1	12	2	1	4	93	7	24	—	—	29	12	—	479	
1947	84	—	—	4	9	154	114	—	23	45	—	189	—	6	28	3	—	7	170	20	12	—	—	30	35	—	933	
1948	64	—	—	13	29	225	163	—	35	31	10	262	—	3	37	8	1	12	186	16	6	—	—	12	60	—	1,173	
1949	51	—	—	3	23	157	72	12	28	49	16	176	—	12	33	7	3	5	114	17	5	—	—	16	40	—	839	
1950	51	—	—	16	29	121	92	33	37	55	35	180	—	13	39	6	11	21	185	36	9	—	—	17	61	—	1,047	6,626
1951	50	—	—	14	32	119	92	27	26	55	23	150	—	10	26	7	18	13	139	40	7	—	—	23	53	—	924	
1952	34	—	—	9	30	98	65	11	26	52	14	130	—	8	14	7	18	21	117	38	9	—	—	26	67	—	794	
1953	40	—	—	12	18	77	59	12	23	55	12	126	—	5	21	10	18	17	81	27	5	—	—	10	58	—	686	
1 954	17	—	—	11	11	83	55	13	16	37	11	88	—	4	19	4	11	12	80	28	7	—	—	15	50	—	572	
Total	1,022	172	865	421	336	2,941	2,602	347	1,155	2,757	121	4,655	301	62	764	301	172	202	4,626	379	84	5	880	826	828	264	27,088	

** Prior to 1938 included in Mining Engineering and Metallurgy.
§ Includes only February and June degrees.

TABLE 14

Degrees of Master of Science Awarded

Class (Calendar Year)	Aeronautical Engineering	Architecture	Biol. & P. H. (Inc. VII-A)	Bldg. & Eng. Constr. XVI	Bus. & Eng. Admin. & Ind. Man.	Ceramics	Chem. Eng. & Nuclear Eng.	Chem. Eng. Practice X-A	Chemistry	Civil Engineering	Economics and Engineering or Natural Science	Electrical Eng. (Inc. VI-A)	Food Technology	Geology & Geophysics	Marine Engineering	Mathematics	Mech. Eng. (Inc. II-A)	Metallurgy	Meteorology	Naval Architecture	Naval Construction & Eng.	Petroleum Engineering	Physics	Sanitary Engineering	Without Course Classification	Total
1886	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1887	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1888	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1889	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1890	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1891	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1892	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1893	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1894	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1895	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	3
1896	—	2	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
1897	—	2	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	4
1898	—	1	—	—	—	—	2	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	5
1899	—	1	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
1900	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1901	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	4
1902	—	3	—	—	—	—	—	—	3	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	8
1903	—	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	—	7
1904	—	4	—	—	—	—	—	—	1	—	—	2	—	—	—	—	1	—	—	—	3	—	1	—	—	12
1905	—	9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	1	—	18
1906	—	3	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	2	3	—	—	—	—	9
1907	—	6	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	8	—	—	—	—	15
1908	—	1	—	—	—	—	—	—	1	—	—	3	—	—	—	—	—	—	—	—	7	—	—	—	—	12
1909	—	6	—	—	—	—	1	—	1	2	—	1	—	1	—	—	1	—	—	—	3	—	1	—	—	17
1910	—	6	1	—	—	—	—	—	1	2	—	1	—	—	—	—	1	—	—	—	7	—	—	—	—	19
1911	—	5	2	—	—	—	—	—	2	2	—	4	—	—	—	—	2	—	—	—	3	—	—	—	—	20
1912	—	4	2	—	—	—	—	—	3	3	—	2	—	—	—	—	—	—	—	—	4	—	—	2	—	20
1913	—	4	1	—	—	—	7	—	—	1	—	1	—	1	—	—	2	—	—	—	2	—	—	—	—	19
1914	—	3	2	—	—	—	3	—	5	3	—	2	—	1	—	—	1	—	—	—	2	—	—	3	—	25
1915	1	4	—	—	—	—	2	—	2	1	—	10	—	—	—	—	4	—	—	1	2	—	—	—	—	27
1916	5	7	1	—	—	—	1	—	3	5	—	6	—	—	—	—	4	—	—	—	2	—	—	1	—	35
1917	4	3	—	—	—	—	1	—	1	3	—	5	—	—	—	—	1	—	—	—	9	—	1	2	—	30
1918	5	1	1	—	—	—	1	—	1	1	—	2	—	—	—	—	2	—	—	—	—	—	—	—	1	15
1919	2	—	—	—	—	—	—	—	3	4	—	4	—	—	—	1	1	—	—	—	—	—	—	—	—	15
1920	—	—	1	—	—	—	3	—	2	4	—	7	—	3	—	1	5	—	—	—	19	—	1	—	4	50
1921	3	—	—	—	—	—	29	—	6	2	—	4	—	2	—	—	10	—	—	—	20	—	—	—	17	93
1922	5	—	—	—	—	—	6	32	4	5	—	37	—	2	—	2	4	—	—	—	10	—	1	—	18	126
1923	10	—	—	—	—	—	3	34	1	5	—	45	—	2	—	—	15	1	—	4	21	—	3	—	26	170
1924	4	—	—	—	—	—	6	41	1	5	—	34	—	1	—	—	8	1	—	—	12	—	5	—	28	146
1925	5	—	—	—	1	—	3	35	3	5	—	35	—	—	—	—	10	2	—	—	—	—	2	1	21	123
1926	6	—	—	—	—	—	5	20	2	2	—	60	—	3	—	—	6	1	—	—	12	—	—	—	25	142
1927	9	—	1	—	—	—	2	26	4	6	—	54	—	6	—	1	13	—	—	—	6	—	1	—	32	161
1928	9	—	—	—	—	—	5	14	2	8	—	63	—	—	—	2	13	—	—	—	9	—	1	—	43	169
1929	5	—	—	—	2	—	3	21	4	6	—	79	—	4	—	2	16	—	—	—	6	—	2	1	45	196
1930	3	—	—	—	1	—	7	22	5	9	—	51	—	1	—	2	5	3	—	1	5	—	1	1	53	170

(*Continued on following page*)

TABLE 14 — (*Continued*)

Degrees of Master of Science Awarded

Class (Calendar Year)	Aeronautical Engineering	Architecture	Biol. & P. H. (Inc. VII-A,B)	Bldg. & Eng. Constr. XVII	Bus. & Eng. Admin. & Ind. Man.	Ceramics	Chem. Eng. & Nuclear Eng.	Chem. Eng. Practice X-A	Chemistry	Civil Engineering	Economics and Engineering or Natural Science	Electrical Eng. (Inc. VI-A)	Food Technology	Geology & Geophysics	Marine Engineering	Mathematics	Mech. Eng. (Inc. II-A)	Metallurgy	Meteorology	Naval Architecture	Naval Construction & Eng.†	Petroleum Engineering	Physics	Sanitary Engineering	Without Course Classification	Total
1931	4	—	2	—	5	—	15	34	5	12	—	57	—	—	2	—	5	10	4	4	—	8	—	2	—	20	189
1932	5	—	5	—	9	—	25	33	8	17	—	56	—	—	2	—	3	16	1	4	—	7	—	6	—	40	237
1933	10	—	1	—	5	—	14	26	7	12	—	46	—	—	—	—	1	18	2	—	1	13	—	4	2	20	182
1934	7	—	5	—	5	—	16	19	11	9	—	46	—	—	3	—	3	20	5	1	—	11	—	3	1	21	186
1935	3	—	1	—	2	—	16	14	4	13	—	55	—	—	—	—	3	16	6	—	—	10	—	7	2	21	173
1936	5	—	—	—	4	2	7	30	3	19	—	22	—	—	2	—	2	14	—	4	1	7	1	5	—	23	151
1937	12	—	1	—	5	1	12	29	8	17	7	35	—	—	—	—	1	15	4	4	—	8	1	2	1	23	186
1938	13	—	—	—	8	—	11	28	1	29	2	58	—	—	—	—	1	24	1	4	—	7	1	3	—	30	221
1939	8	—	3	—	8	—	20	34	1	31	3	45	—	—	2	—	1	21	6	6	—	8	—	5	2	28	232
1940	9	—	1	—	9	—	16	37	3	20	—	54	—	—	4	—	5	22	7	8	18	10	2	3	2	37	267
1941	16	—	1	—	12	—	15	42	3	10	3	35	—	—	3	1	2	25	7	18	14	22	—	4	1	25	259
1942	9	—	2	—	16	1	12	23	2	5	1	24	—	—	2	15	1	24	8	11	—	9	—	—	1	7	173
1943	21	—	1	—	—	—	15	36	3	9	—	30	—	—	2	7	—	26	5	14	—	18	—	2	1	4	194
1944	22	—	—	—	1	1	3	7	2	9	—	13	—	—	—	—	—	12	5	11	1	55	—	—	3	5	150
1945	9	—	3	—	1	—	12	—	3	5	—	25	—	—	—	—	2	11	7	6	—	23	—	2	3	9	121
1946	47	—	1	—	4	—	29	2	5	24	—	45	—	2	—	5	47	4	5	3	46	—	2	4	9	284
1947	67	—	5	—	18	—	65	32	12	47	1	63	5	5	3	9	64	13	8	4	—	—	10	13	12	456
1948	40	—	4	9	19	1	31	39	13	30	5	92	—	—	4	5	63	11	12	—	33	—	5	9	13	438
1949	44	—	6	5	29	—	36	41	7	26	3	109	5	1	2	10	58	15	8	3	—	—	11	9	19	447
1950	32	—	2	7	22	—	57	19	3	29	3	110	2	2	—	11	58	17	6	3	—	—	14	9	20	426
1951	40	—	4	3	25	1	56	30	8	20	2	106	1	5	5	14	53	20	8	3	—	—	12	10	18	444
1952	29	—	7	4	26	—	36	19	4	24	3	111	2	2	2	6	32	29	19	2	—	—	15	7	26	405
1953	36	—	7	12	26	—	34	12	11	34	—	102	3	2	2	8	49	17	22	2	—	—	16	8	36	439
*1954	29	—	3	2	59	—	21	23	1	26	1	65	6	5	1	4	41	15	10	4	—	—	8	6	43	373
Total	593	84	78	42	322	7	666	854	195	562	34	1,916	24	73	42	113	870	217	193	67	478	5	164	107	822	8,528

Total of degrees in discontinued courses, Architectural Engineering, Electrochemical Engineering, Fuel and Gas Engineering, General Science, Mining Engineering, Naval Construction (Foreign Students), and Railroad Operation (see 1940–41 Report)	126
Grand Total	8,654

* Includes only February and June degrees.
† Beginning 1949 see Naval Engineer, Table 17.

TABLE 15

Degrees Awarded in Architecture and City Planning

Class (Calendar Year)	Bachelor in Architecture	†Bachelor in City Planning	Master in Architecture	Master in City Planning
1921	—	—	3	—
1922	—	—	2	—
1923	—	—	7	—
1924	—	—	8	—
1925	—	—	5	—
1926	—	—	9	—
1927	—	—	7	—
1928	—	—	6	—
1929	—	—	9	—
1930	—	—	7	—
1931	—	—	9	—
1932	11	—	5	—
1933	24	—	7	—
1934	27	—	—	—
1935	17	4	11	—
1936	14	4	4	2
1937	9	2	11	3
1938	19	1	3	3
1939	14	1	10	3
1940	11	2	21	7
1941	17	2	6	1
1942	15	1	4	4
1943	10	—	3	6
1944	8	—	2	3
1945	5	—	—	7
1946	7	—	2	8
1947	9	1	20	15
1948	11	3	14	13
1949	24	2	10	12
1950	20	4	17	13
1951	27	2	20	12
1952	33	1	15	10
1953	31	—	19	9
*1954	22	1	6	10
Total	385	31	282	141

* Includes only February and June degrees.
† From 1935 to 1944 Bachelor of Architecture in City Planning.

TABLE 16

Degrees of Master in Public Health Awarded
(Discontinued after 1944)

Class (Calendar Year)	Number of Degrees Awarded		
	Prior to 1948	1948*	Total
1923	—	2	2
1926	—	1	1
1927	—	2	2
1929	—	1	1
1930	—	5	5
1931	—	4	4
1933	—	7	7
1934	—	4	4
1935	—	4	4
1937	—	6	6
1938	—	2	2
1939	—	6	6
1940	—	7†	7
1941	3	6	9
1942	11	1	12
1943	10	10	20
1944	7	5	12
Total	31	73	104

*72 former recipients of the Certificate of Public Health were awarded the degree of Master in Public Health in June 1948 as of the class in which they received their Certificate of Public Health.

†Includes 1 degree awarded in June 1954.

TABLE 17

Degrees of Advanced Engineering Awarded

Class (Calendar Year)	Aeronautical Engineer	Building Engineer	Chemical Engineer	Civil Engineer	Electrical Engineer	Mechanical Engineer	Metallurgical Engineer	Meteorologist	Naval Architect	Naval Engineer	Sanitary Engineer	Total
1949 . . .	—	—	—	—	2	—	—	1	—	37	—	40
1950 . . .	2	—	—	—	10	8	2	—	—	27	—	49
1951 . . .	3	—	1	—	9	10	2	—	1	33	—	59
1952 . . .	2	—	—	1	6	13	1	1	—	38	3	65
1953 . . .	3	—	—	3	4	8	1	—	—	19	—	38
*1954 . . .	3	2	1	—	5	6	3	—	—	29	1	50
Total . .	13	2	2	4	36	45	9	2	1	183	4	301

* Includes only February and June degrees.

TABLE 18

Degrees of Doctor of Philosophy Awarded

Class (Calendar Year)	Biology	Chemistry	Electrical Engineering	Food Technology	Geology	Industrial Economics	Mathematics	Physics	Group Psychology	Total
1907	—	3	—	—	—	—	—	—	—	3
1908	—	3	—	—	—	—	—	—	—	3
1909	—	—	—	—	—	—	—	—	—	—
1910	—	1	—	—	1	—	—	—	—	2
1911	1	—	—	—	—	—	—	—	—	1
1912	—	3	—	—	3	—	—	—	—	6
1913	—	1	—	—	—	—	—	—	—	1
1914	—	2	—	—	—	—	—	—	—	2
1915	—	2	—	—	—	—	—	—	—	2
1916	—	1	—	—	1	—	—	1	—	3
1917	—	3	—	—	1	—	—	—	—	4
1918	—	3	—	—	1	—	—	—	—	4
1919	—	—	—	—	—	—	—	1	—	1
1920	—	4	—	—	1	—	—	—	—	5
1921	1	3	—	—	—	—	—	3	—	7
1922	—	4	—	—	1	—	—	—	—	5
1923	—	5	—	—	1	—	—	—	—	6
1924	2	10	—	—	—	—	—	2	—	14
1925	—	11	—	—	—	—	—	—	—	11
1926	—	2	—	—	2	—	—	—	—	4
1927	2	6	—	—	1	—	1	1	—	11
1928	1	5	—	—	1	—	1	—	—	8
1929	4	8	—	—	2	—	1	—	—	15
1930	—	5	—	—	2	—	3	—	—	10
1931	—	9	—	—	—	—	1	—	—	10
1932	1	12	—	—	—	—	1	2	—	16
1933	2	10	—	—	3	—	3	—	—	18
1934	2	10	—	—	2	—	2	1	—	17
1935	4	15	—	—	2	—	3	7	—	31
1936	—	15	—	—	—	—	3	12	—	30
1937	2	11	—	—	4	—	1	10	—	28
1938	2	12	—	—	2	—	4	7	—	27
1939	1	33	—	—	4	—	3	4	—	45
1940	3	19	—	—	5	—	4	5	—	36
1941	1	18	—	—	1	—	3	5	—	28
1942	1	19	—	—	5	—	1	8	—	34
1943	2	8	—	—	2	—	3	8	—	23
1944	2	12	—	—	—	1	—	9	—	24
1945	1	6	—	—	—	—	1	1	—	9
1946	2	5	—	1	—	4	4	1	—	17
1947	3	14	1	1	—	3	4	17	—	43
1948	3	27	—	—	5	1	8	34	5	83
1949	2	40	—	2	4	3	5	36	3	95
1950	4	31	—	—	3	7	6	40	—	91

(*Continued on following page*)

TABLE 18 — (*Continued*)

DEGREES OF DOCTOR OF PHILOSOPHY AWARDED

Class (Calendar Year)	Biology	Chemistry	Electrical Engineering	Food Technology	Geology	Industrial Economics	Mathematics	Physics	Group Psychology	Total
1951	2	30	—	—	8	7	7	30	—	84
1952	4	30	1	1	9	7	7	27	—	86
1953	1	37	—	5	7	8	7	31	1	97
*1954	3	15	—	1	5	9†	4	22	—	59
Total	59	523	2	11	89	50	91	325	9	1,159

* Includes only February and June degrees.

† Includes one in Psychology.

TABLE 19. DEGREES OF DOCTOR OF SCIENCE AWARDED

Class (Calendar Year)	Aero. Eng.	Ceramics	Chem. Eng.	Chemistry	Civil Eng.	Elec. Eng.	Electrochem. Eng.	Food Technology	Geology	Mathematics	Mech. Eng.	Metallurgy	Meteorology	Min. Eng.	Naval Arch.	Petroleum Eng.	Physics	San. Eng.	Total
1911	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1
1912	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1913	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1914	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1915	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1
1916	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1917	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1
1918	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1919	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1920	1	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	3
1921	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1922	1	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	3
1923	1	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	2	—	5
1924	—	—	2	—	—	1	—	—	1	—	—	1	—	—	—	—	1	—	6
1925	1	—	3	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	7
1926	—	—	1	1	1	1	1	—	—	—	—	4	—	—	—	—	—	—	9
1927	—	—	—	—	—	1	—	—	—	1	1	2	—	—	—	—	1	—	6
1928	1	—	5	—	1	2	—	—	—	—	—	1	—	—	—	—	—	—	10
1929	—	—	3	—	—	—	—	—	—	—	—	1	—	—	1	—	1	—	6
1930	—	—	9	—	—	6	—	—	—	1	3	1	—	—	—	—	—	—	20
1931	—	—	3	2	—	3	—	—	—	—	—	1	—	—	—	—	—	—	9
1932	—	—	5	—	1	2	—	—	1	—	2	1	—	—	—	—	2	—	14
1933	—	—	10	1	2	3	—	—	—	1	—	6	—	1	—	—	—	—	24
1934	—	—	3	—	—	2	1	—	1	—	3	2	1	—	—	—	—	—	13
1935	—	1	2	1	—	4	—	—	—	2	—	1	1	—	—	—	1	1	14
1936	2	1	12	—	—	1	—	—	—	—	2	3	—	1	—	—	2	—	24
1937	1	1	9	1	1	6	—	—	—	—	2	—	—	—	—	1	1	—	23
1938	—	1	12	—	2	7	—	—	1	—	2	5	3	—	—	—	5	—	38
1939	2	1	10	—	3	1	—	—	—	—	—	4	1	1	—	—	3	—	26
1940	—	2	12	—	3	1	—	—	1	—	2	2	—	1	—	—	4	1	29
1941	1	1	15	3	—	3	—	—	—	—	3	8	3	—	—	—	3	1	41
1942	1	2	14	—	2	—	—	—	—	—	1	3	1	—	—	—	2	—	26
1943	—	2	10	—	—	1	—	—	—	—	—	5	—	—	—	—	2	—	20

(Continued on following page)

TABLE 19. DEGREES OF DOCTOR OF SCIENCE AWARDED — (*Continued*)

Class (Calendar Year)	Aero. Eng.	Ceramics	Chem. Eng.	Chemistry	Civil Eng.	Elec. Eng.	Electrochem. Eng.	Food Technology	Geology	Mathematics	Mech. Eng.	Metallurgy	Meteorology	Min. Eng.	Naval Arch.	Petroleum Eng.	Physics	San. Eng.	Total
1944	2	—	4	—	—	1	—	—	2	—	1	4	—	—	—	—	1	—	15
1945	—	1	7	—	2	—	—	—	—	—	1	3	1	—	—	—	—	—	15
1946	1	—	11	—	3	1	—	—	1	—	2	1	2	—	—	—	1	—	23
1947	2	1	10	—	2	4	—	2	1	—	2	11	1	—	—	—	1	—	37
1948	3	1	10	—	3	3	—	—	1	—	4	9	9	—	—	—	3	—	46
1949	2	5	21	—	6	8	—	—	—	—	7	15	4	—	—	—	1	2	71
1950	6	3	12	1	5	13	—	1	—	—	14	11	4	—	—	—	—	—	70
1951	5	2	10	—	7	11	—	—	—	—	10	19	2	—	1	—	3	4	74
1952	3	2	13	1	5	16	—	2	—	—	9	14	3	—	—	—	1	3	72
1953	4	3	12	—	2	14	—	1	—	—	16	16	3	—	—	—	—	2	73
*1954	4	5	6	—	1	7	—	—	1	1	13	15	3	—	—	—	—	2	58
Total	45	35	256	12	52	127	2	6	13	6	100	173	42	5	2	1	41	16	934

* Includes only January and June degrees.

TABLE 20

DEGREES OF DOCTOR OF PUBLIC HEALTH AWARDED
(Discontinued after 1944)

Class (Calendar Year)	Number
1924	1
1927	1
1928	1
1930	1
1939	1
1942	1
1944	3
Total	9

TABLE 21

DEGREES OF DOCTOR OF ENGINEERING AWARDED
(Discontinued after 1918)

Class (Calendar Year)	Electrical Engineering	Electrochemical Engineering	Total
1910	1	—	1
1914	1	—	1
1916	1	—	1
1917	—	1	1
Total	3	1	4

TABLE 22

SUMMARY OF DEGREES AWARDED (1868–1954)

Bachelor of Science	27,088
Bachelor in Architecture	385
Bachelor in City Planning	31
Master of Science	8,654
Master in Architecture	282
Master in City Planning	141
Master in Public Health (Discontinued after 1944)	104
Advanced Engineering	301
Doctor of Philosophy	1,159
Doctor of Science	934
Doctor of Public Health (Discontinued after 1944)	9
Doctor of Engineering (Discontinued after 1918)	4
Grand Total	39,092

JOSEPH C. MACKINNON

Adviser to Foreign Students

In the academic year 1953–54, 596 foreign students were enrolled at the Institute; of these 265 were undergraduate and 331 were graduate students. They were citizens of 76 different countries.

During the year just past 2,052 inquiries or informal applications came to this office from prospective students who wished to enter M.I.T. in September, 1954, or from others who wrote in their behalf. These applications came from citizens of 89 countries. They were written by young men and women; by their parents, employers and friends; by their own governments whose scholarships they had won; by foreign firms subsidizing their young scientists and engineers for advanced study; by the American government and its many branches — State Department, Foreign Operations Administration (Point Four), Health Service, and others; from bi-national organizations, such as the American-Scandinavian Foundation and the English-Speaking Union; from American societies such as Rotary and the Association of American University Women with fellowship offers for foreign students. One was a Rajah from India who wrote on behalf of one of his many grandsons. One was a poor boy in Nigeria who offered to indenture himself to me for twenty years if I would subsidize the education he so passionately desired. One inquiry was from a Norwegian who was radar officer on a whaler; I was to reply to his wife, since he would be away for six months, but he was in touch with her every day by radio-telephone. Another came from a Korean who as evidence of his sincerity included with his application a message written in his own blood.

Below is a table listing the number of inquiries, for each of the last three years, from 14 countries of the 89 heard from.

	1952	1953	1954
Brazil	33	56	61
China	88	120	84
Colombia	46	57	51
Cuba	30	53	67
France	41	53	63
Great Britain	115	145	128
Greece	80	64	85
India	224	296	305
Israel	88	49	58
Japan	25	65	67

Korea	11	35	71
Pakistan	14	27	51
Philippines	46	58	75
Venezuela	70	65	54
Total Inquiries from *all* countries (many not listed)	1541	1935	2052

One inquiry was received from each of the following: Azores, Bahamas, Ceylon, Ethiopia, Guam, Kuwait, Liechtenstein, Liberia, Mozambique, Reunion, Vietnam, Yugoslavia and Zanzibar.

As indicated above, the motivation for many of these applications came from the industrial or political considerations of business and research organizations or from governmental agencies; that of many more came from the initiative of the individual applicants. From this point of view, the figures in the above table opposite Korea are of interest. With the cessation of hostilities came a number of inquiries from organizations of all kinds, an even larger number from eager — and usually impoverished — students and a great many from American service men who had made friends in Korea and wished to help them. In 1952 no Korean students were at M.I.T.; in 1953 there were two; of the 71 who applied for 1954 nine were admitted.

The Foreign Student Summer Project has completed another successful program. Fifty-eight young men and women from 33 countries attended classes, worked in laboratories and visited industries in Greater Boston and throughout the eastern United States. Chairman of the undergraduate committee, which had complete responsibility for the Project, was Mr. D. Paul Foote. As in past years, F.S.S.P. was generously supported by the Alfred P. Sloan Foundation, Inc.

For 1954–55, twenty graduate students and recent alumni of M.I.T. have been granted Fulbright Scholarships for study abroad. Their selection was made initially by a screening committee of M.I.T. Faculty members headed by Professor David A. Dudley, Fulbright Adviser and Assistant Director of Admissions.

For a number of years an Overseas Summer Fellowship Program has been administered by a Faculty committee headed by Professor Norman J. Padelford. The committee arranged for summer jobs abroad in industries, research organizations and university laboratories for students in the process of acquiring an advanced degree at the Institute. In general, the pay earned abroad

would just meet living expenses; travel funds were awarded as Overseas Fellowships from funds donated for this purpose.

In spite of the successful operation of this program for several years and its evident value to our students, the committee was forced to announce its abandonment for 1954 for lack of supporting funds. At this juncture a number of graduate students stepped in, most of them members of the recently activated Graduate Student Council, and by their enthusiastic and skilful efforts secured the necessary funds. These were supplied by the Food Machinery and Chemical Corporation. Through their generosity, in the summer of 1954 sixteen graduate students were awarded Overseas Fellowships which permitted them research or industrial experience in Belgium, England, France, Italy, The Netherlands, Sweden and Switzerland.

PAUL M. CHALMERS

Director of Libraries

Alumni Day, June 14, brought many visitors to the Charles Hayden Memorial Library who were impressed and pleased by a new innovation, the furnishing of the "blue corridor" as a distinctive and convenient lounge. The adjacent central courtyard has also been completely rearranged and, through the generosity of the Boston Stein Club, thirty yachting chairs together with planting boxes filled with attractive shrubbery and flowers have been installed. The corridor and courtyard, depending on the season and the weather, continue and extend our tradition of convenient access to books and comfortable places to read them.

Less obvious but considerably more important behind-the-scenes changes have taken place. The fifth floor stacks of the Engineering Library have been cleaned, relighted and repainted, marking further progress in the renovation of this important divisional library. The Rotch Library has been brought up to date by

the replacement of wooden shelving and cabinets (some of which originated in the Rogers Building) by modern steel shelving and some additional furniture. The architecture and planning books, therefore, can be reorganized and better housed. The long-planned humanities mezzanine on the second floor of Hayden will become an actuality by the beginning of the fall term. With its completion the major humanities collections will be brought together in closer proximity to the General Library and the union catalogue. A by-product will be the elimination of the north wing traffic bottleneck and improved access to the Music Library. Other minor touches here and there have contributed to improve even further the spaces allocated to the library system.

Operations. There were no major organizational changes in the library during the year; the system of one General and five Divisional Libraries has successfully met present requirements. The Executive Board of the Faculty Committee on the Library under the able chairmanship of Professor Michael B. Bever completed the review of the Metcalf Report and began preliminary consideration of the organization of the Faculty Committee itself; intensive studies of the status and development of library collections will follow. Committee recommendations relating to the Metcalf Report over the past three years, together with those of the Visiting Committee on the Library which met this year on March 19, have largely been implemented. The two Ad Hoc Advisory Committees for the Science and Engineering Libraries, chairmanned by Professors Philip M. Morse and Warren M. Rohsenow, respectively, continued to render effective service in the programs and activities of these libraries. The Committees for the Rotch, Humanities and Dewey Libraries devoted particular attention to collections and to book selection.

The official count of books in the library now stands at 523,213, including net additions (less discards) of 23,760 volumes. Over 39 per cent more titles were added than last year, but this abnormal increase merits some explanation. Actually as compared to 1952–53 some 450 fewer books were purchased, while twice as many gifts were received; theses increased by 166, and processing of a large backlog of serial material, principally Government documents, was completed.

With the co-operation of the Faculty, the library staff continued to review the library collections critically. Deficiencies as revealed were remedied to the extent of available resources. As in past years the library has received important gifts of useful books and other material from many sources. Of particular note are the gifts of books for the Humanities Library from the private collection of Mr. Carl T. Keller, a member of the Visiting Committee; his regular donations for the purchase of books are most useful. Former Institute Librarian, Professor Emeritus Robert P. Bigelow, allowed the library to make a selection from his collection of first editions in the field of biology. Two new endowment funds were added. The Boston Stein Club Library Fund, whose income is designated for the purchase of general library books, was presented. Mr. George C. Putnam '36 established a fund in memory of his father, James Russell Putnam '01, the income to be used for the purchase of books in the field of horology.

The exceptional amount of material accessioned this year placed a heavy load on the Processing Department which was not diminished by the new task of purchasing and cataloguing books and periodicals for the Center of International Studies. None the less the year closed without excessive backlogs. As a result of the success of the divided catalogue of the Science Library, a similar divided catalogue was prepared for the Engineering Library. The meticulous and apparently endless records-change project brought about by the transfer of materials between libraries continued, and the end is not yet in sight.

Library Use. The use of a library, like the weather, is conceded to be extremely difficult to predict. This year, with the assistance of Professor Morse's operations research group, Mr. Martin L. Ernst was assigned to undertake a survey on the use made of the library. One part of his preliminary report considers circulation characteristics as an index to the use of the library. Although the study was hampered by incomplete data and by several changes in the location of books, some interesting general characteristics are beginning to appear. The relative stability of circulation throughout the library system suggests that a good portion of the circulation is more or less predetermined. If this proves to be the case, it will be easier to evaluate organizational systems in terms of the use of

the library and at the same time to measure the efficiency of library performance. The study also provides valuable data on the relationship of circulation to accessions budgets and the ratio of financial support required by the more active components of a collection. Library budgets are chronically inadequate and this approach can serve as a guide to the establishment of priorities. The rule of thumb frequently allocates funds to the more clamorous users to the detriment of the less vocal.

On the basis of regular statistics for the year, two-week circulation maintained its previous level while overnight borrowing sharply increased in particular areas. Possibly the longer hours in the Humanities and Engineering Libraries are responsible in part for large increases in room use and overnight circulation. In the Science Library, which remained open 360 days in the year, circulation continued to advance. No accurate record of the number and kinds of readers is available, nor indeed can be made under present conditions. Reading privileges for those without Institute connections have been made available to serious workers on a fairly liberal scale and the demand continues to increase. Most outside readers also wish to borrow books. The possibility of devising a reader's card, advanced by the Executive Board of the Faculty Committee on the Library, has been approved in principle and at an appropriate time will be inaugurated. Traditional statistics, operations analyses and the experience of the staff conclusively demonstrate that the libraries were in fact intensively used.

The other part of Mr. Ernst's report was addressed to a critical examination of the chronic problem of lost books. In a library such as that at M.I.T., where every effort is made to provide a maximum of high-use material on open shelves, where the honor system is in effect without guards at library entrances and without the examination of brief cases, a certain amount of loss is inevitable. The physics collection was inventoried for missing books in 1950 and again in 1954; the results when analyzed statistically seem to indicate that 15 per cent of the lost books are found within the first year and eventually 30 per cent find their way back to the collection. Financially, on the basis of this sampling, the costs of replacement over a six-year period are not too alarming, but no measure has yet been devised to ascertain reader inconvenience caused by not obtaining a desired piece of material which should be in the library.

Co-operation of Faculty members and students can keep the loss figure well below the danger point.

The increasing importance of adequate literature research for business and industry has been reflected in growing demands on the library. In addition to company librarians and others enjoying reading privileges within the library, the inter-library loan service and its corollary, the Microreproduction Service, were heavily taxed. A year ago it became necessary to exclude periodicals from inter-library loan in order to meet the requirements of longer library hours. The Institute also borrows material from other libraries, but at present three times as much material is loaned as is borrowed. The loan figures also manifest another important characteristic. Of the material loaned twice as many items went to commercial concerns from whom the library rarely if ever can borrow as was sent to other institutional libraries who are able to reciprocate. Inter-library loan to company libraries is often discouraging because the loan code is not always followed. Furthermore the impact of telephone calls, correspondence and personal visits requires an increasingly large percentage of the time of the Reference Department which could well be employed in better service to the Institute. The obvious answer is to establish an Industrial Reference Service, and this plan is now under consideration.

Requests for photographic duplication increased over 40 per cent. Some orders resulted from the publication of the abstract volumes of Doctors' theses. Availability, through the Microreproduction Service, of complete texts of M.I.T. theses in the form of microfilm reproductions has filled a need; 1583 theses, about 14 per cent more than last year, were reproduced in this form. Photostats, despite the difficulties of furnishing them, increased by more than 10 per cent. Business and industrial firms in the vicinity as well as those at a distance have asked for a rapid and convenient photo-copying service for short-run material including periodicals. A service of this type, for which the recipients are able and anxious to pay, would mark a long forward step in the utilization of M.I.T. collections.

An interesting experiment was completed during the year. Table-of-contents pages of selected journals in the fields of electrical engineering, humanities and physics were reproduced for

distribution to Faculty members, projects, laboratories, divisional libraries and individuals. As soon as a new issue is received a reduced-size photographic negative is made of the table-of-contents page. Negatives are accumulated and reproduced for distribution at appropriate intervals by Multilith. Delivery of a packet of pages indicates that the journal has been received in the library and affords the reader an opportunity to scan the contents of current literature. The plan was received with enthusiasm and arrangements are being made for continuation. Other library publications include the "Brief Guide to Institute Libraries" intended for freshmen and new students, the library news sheet "About M.I.T. Libraries," accessions lists and related items.

A 16mm. color sound motion picture, "Bibliodynamics — The Charles Hayden Memorial Library," was completed and put to use during the year. The library is greatly indebted to Oscar H. Horovitz '22 who made the production possible. The script was designed to afford to new students, visitors and others a reasonably complete view of the Charles Hayden Memorial Library in 21 minutes, and at the same time to instruct them in its use. Mr. Horovitz contributed the photography, editing and sound recording. The voice of the narrator is that of Professor Paul M. Chalmers. Three prints have been made. One is kept in the Projection Room for staff and student showings, the second is loaned from time to time to alumni and other libraries. The Department of State has asked to borrow this print for use in Latin America, at which time it can also be shown to M.I.T. alumni in South America. The third print was purchased by Columbia University for use in the Library School. The film has been a real success.

To conclude on a pleasing note, the Music Library enjoyed its most successful year to date. As a result of the interest of Professor Jerome B. Wiesner and the Research Laboratory of Electronics, a new three-channel audio system designed by Dr. Manuel V. Cerrillo was provided and installed to supplement the large concert equipment. With separate speakers for bass, treble and middle tones, the instrument adds a new dimension to recordings. New shelving for books and scores had to be fitted this year, and a generous gift of funds from Professor Edward L. Bowles for the purchase of playing scores of chamber music is helping to fill the

additions. Programs of live and recorded music, formal and informal seminars and recreational and required listening combined to fill and even at times to tax the extensive facilities that the Music Library affords.

VERNON D. TATE

Medical Director

The work of the Medical Department this year has followed the general pattern established during the past seven years. New and better ways of making proper use of medical skills, concepts and attitudes in the furtherance of the educative process are constantly being sought. For the most part these new ways lie in the area of health building, with firm foundations in diagnosis and treatment and in strictly preventive procedures. Health building procedures, including physical, emotional and social health, have been carried out by means of group discussions of emotional and social issues with first-year men, biology and premedical students, Faculty and student counselors and instructors interested in improving this aspect of their teaching. Brochures on such items as allergy, gastro-intestinal disorders, the common cold, smoking and lung cancer, fatigue and anemia have been distributed widely. Numerous lectures to classes in other departments that are considering matters of health import have been given. Members of the Medical Department have participated in many group discussions in fraternities and dormitories on an enormous variety of subjects of concern to students. Finally, talks on these procedures to community groups, teachers and Faculty members and students of other colleges have served to add perspective to our own efforts.

During the past year the Medical Director has served as President of the American College Health Association and as Chairman of the Fourth National Conference on Health in Colleges. The latter is a loosely organized group of all persons interested in

promoting and maintaining the highest possible standards of health among students, Faculty and staff members, which meets every seven to ten years to evaluate and report on progress that has been made in student health programs. Among the 520 persons attending the Conference were many college presidents, deans and faculty members interested in counseling, as well as physicians, health educators and nurses, which indicates on the national scene that health is everybody's concern and not just the province of those who treat disease. This principle has been actively observed at M.I.T. in that a great deal of the Medical Department's work is with people who are not sick.

The statistical summary of visits to the various services during the year is as follows:

Surgery	10,438
Medicine	7,780
Psychiatry and neurology	3,050
Otolaryngology	1,482
Ophthalmology	1,094
Dermatology	1,331
Dental	4,859
Emergency clinic	1,792
Physical examinations	3,405
Occupational medicine	1,051
Radiology	10,536
	46,818
Division of Defense Laboratories	3,602
Total	50,420

Continuing the trend of past years, 58 per cent of the calls in the main headquarters of the Medical Department were made by students, 42 per cent by staff members and employees. In the Homberg Memorial Infirmary 696 persons were admitted, of whom 557, or about 80 per cent, were students. The total number of patient-days was 2,487, of which number 71 per cent represents students. This decrease in the number of patient-days in the Infirmary continues a trend of several years, but it was accentuated to some extent this year because the Infirmary was not open during July and August. It is a safe estimate, based on experience in past years, to assume that there would have been about 150 patient-days during this period. This still does not change the fact that each year we have fewer people hospitalized in the Infirmary than the year previously. There were only six cases of the common contagious diseases during the year. Three

cases of active tuberculosis were discovered, two of them in students and one in a Faculty member. The Clinical Pathological Service performed 12,346 laboratory tests during the year.

The Division of Defense Laboratories has been in the process of moving during this year, and, as a result, the number of calls to the separate first-aid station set up in the new location in Lexington has increased gradually from 210 in July, 1953, to 478 in June, 1954. Only comparatively minor and routine illnesses are cared for in this clinic, and all serious problems are referred to the Medical Department in the Institute. The clinic is staffed by a full-time nurse and a part-time physician. The total number of calls during the year in this first-aid clinic was 3,602.

The Occupational Medical Service has been engaged during the past year in making thorough medical evaluations of all the D.I.C. staff members. A total of 954 of these examinations were done on the staff, including D.I.C. and D.D.L., on a voluntary basis, and only five persons of the entire D.I.C. staff were unwilling to have the physical examination. From now on all new members of the staff will be examined in the same fashion. The data obtained from these examinations will be of great benefit to the individuals concerned in caring for future illnesses or injuries and will be of indirect value in long-term observations on the health of the M.I.T. community.

The experience in the Psychiatric Service was somewhat different from that of past years in that a major portion of the psychiatrists' time was spent in group work and in conferences with various persons in the Institute other than the usual patient-physician interview. The total number of interviews was 3,050, and the total number of persons seen was 485, or an average of slightly more than six hours per person. Of the total number, 357 were students, 61 were Faculty members and 54 were employees.

In the spring of 1954 members of the Psychiatric Service served as group discussion leaders in a series of four to five meetings with all the students who are to be counselors next year. The role of the counselor and possible reactions and problems of the new students formed the substance of the discussions. These groups contained eight to twelve students each, and about 70 students attended all sessions out of about 100 who began them. Attendance was purely voluntary.

In the Faculty Health Survey, 237 Faculty members had a complete health inventory, and of this number 30 were new additions to the Survey. Two deaths, both from coronary occlusion, occurred in this group. The study on possible connections between blood lipo-protein and cholesterol levels and atherosclerosis is being continued.

I would especially like to express my profound appreciation to the administration for its continuous and thoughtful support of the Medical Department during the past eight years. Whatever measure of success the Department has achieved in its attempt to meet the health needs of the Institute could not have been accomplished without this warm backing. The vision shown by the late President Compton and President Killian in regard to health planning has been the source of constant inspiration to all members of the Medical Department.

DANA L. FARNSWORTH

Heads of the Departments of Military and Air Science

A total of 896 undergraduate students were enrolled in the Army R.O.T.C. program at M.I.T. during the 1953–54 academic year. Of this number 274 were advanced course students.

During the past year the Air Force R.O.T.C. program comprised 359 freshmen, 300 sophomores, 77 juniors and 111 seniors. The drop in the number of juniors was brought about by a general reduction throughout the Air Force R.O.T.C. program. The emphasis in the future will continue to be upon quality instead of quantity. The limited number of spaces available for the Advanced Corps will make for keen competition among all cadets desiring to remain in the program.

Of the graduating seniors in Air Force R.O.T.C., 52 were awarded and accepted Second Lieutenant's commissions in the Air Force Reserve. (Seventeen chose flying training and

35 chose technical training). 35 other seniors were awarded certificates of completion. In turn they were offered Air National Guard commissions, and 32 accepted.

Department of Air Science. During the past year there was a complete change in the air science academic curriculum, whereby all colleges and universities offer the same Air Force R.O.T.C. program. The general curriculum now being offered is more practical and realistic for the time available. Subjects being offered include Fundamentals of Global Geography, International Tensions and Security Organizations, Elements of Aerial Warfare (Targets, Weapons, Air Craft, Operations), Problem-Solving Techniques, Military Justice, Applied Air Science (Aerodynamics and Propulsion, Navigation, Weather), Problems of Leadership and Management (Seminar) and Military Aspects of World Political Geography.

In addition to the educational requirements an Air Force officer must always have a high degree of discipline and courtesy. So far, graduating Air Force R.O.T.C. cadets have shown an apparent lack of these qualifications upon entering active duty. Therefore every cadet in every school is being made fully aware that a major re-emphasis is under way and will continue at an increasing tempo, toward this end.

During the past year orientation flights were given to approximately 250 cadets, each cadet receiving 15 minutes' stick time. The program was conducted on a voluntary basis and was enthusiastically received throughout the cadet corps. A major part of the success of this program was due to the efforts of Major Clifford D. Coble.

The Department has been very successful in its efforts to broaden its teaching by including lectures by professors from other departments of the Institute. Last year some of the guest lecturers were Professor Thomas F. Malone, Meteorology; Professors Paul E. Sandorff, Otto C. Koppen, Elmer E. Larrabee, and Walter McKay, Aeronautical Engineering; Professor Vincent J. Roggeveen, Civil Engineering; and Professor Robert C. Dean, Jr., Mechanical Engineering. Other guest lecturers included officers from the Department of Naval Science at Harvard University, Otis Air Force Base, and Cambridge Air Force Research Center. Major Coble and Major Smith have completed their tour at the Institute. First

Lieutenant Theodore R. York, Captain Frederick W. Dederich, and Captain Willard D. Tease are new additions to the staff.

The major problem encountered during the past year was caused by the increased emphasis placed by the Air Force on flying training. In previous years all students selected for the advanced course were commissioned Second Lieutenants in the United States Air Force Reserve. This year and in future years only those electing flying training and a very limited number in specified technical fields will be commissioned. We must, therefore, readjust our program but we believe that drastic change and uncertainty in the Air Force R.O.T.C. program, such as we have seen this last year, will be eliminated in the future.

The staff is competent and enthusiastic. The facilities, though limited, are adequate and the curriculum greatly improved with special emphasis on leadership development. Throughout our training program we believe that character, spiritual strength and a trained mind are qualities necessary to a rewarding and useful life. VINCENT J. GANGEMI

Department of Military Science and Tactics. President Killian proclaimed May 12, 1954, as Military Day at M.I.T. A combined Army-Air Force R.O.T.C. military review was held on that date with approximately 1,500 M.I.T. R.O.T.C. cadets participating. President Killian served as reviewing officer. Distinguished military guests included Major General Roderick R. Allen, Commanding General, Fort Devens, Massachusetts; Brigadier General Joseph C. Odell, Commanding General, Research and Development Laboratories, Natick, Massachusetts; and Brigadier General Charles E. Loucks, Deputy Chief of the Army Chemical Corps. During the review ceremony 14 Army R.O.T.C. cadets received awards for outstanding leadership and military proficiency.

On June 10, 1954, 80 advanced course students who had completed their R.O.T.C. training were commissioned as Second Lieutenants in the United States Army Reserve. Formal presentation of commissions was made in a special commissioning ceremony at which the late Dr. Karl T. Compton; Brigadier General Ralph W. Zwicker, U. S. Army, Commanding General, Camp Kilmer, New Jersey; and Brigadier General Kurt M. Landon, U. S. Air Force, were the principal speakers. Forty-one additional advanced

course students were commissioned on July 30, 1954, upon completion of R.O.T.C. summer camp training, making a total of 121 as our reserve officer production for the year.

On June 11, 1954, the Department was visited by Major General John F. Uncles, Chief of Research and Development, Department of the Army, who represented the Army at graduation exercises on that date.

The past year was marked by a change of department heads within the Military Science Department. On March 31, 1954, Colonel Charles F. Baish, for four years Professor of Military Science and Tactics, retired from active duty after 39 years of Army service and was replaced by Colonel Charles M. McAfee, Jr.

Class attendance in the advanced R.O.T.C. course at M.I.T. is limited to three hours per week as compared to the five hours per week specified by current Army Training Programs and in effect at most other educational institutions. M.I.T. R.O.T.C. instructors are therefore faced with the problem of preparing their students to compete successfully, particularly at summer camps, with students from other colleges and universities offering substantially longer military science courses. This curtailment of the military science program at M.I.T. has, in the past, undoubtedly resulted in M.I.T. students' achieving lower proficiency ratings at summer camp than they might otherwise attain and has in some instances caused M.I.T. students to suffer an excessively high rate of attrition at summer encampments. With this problem in mind, increased emphasis was placed this year on the development of individual leadership with a view to establishing a greater degree of self-confidence in the student, improving his ability to command and lead others and familiarizing him with the techniques of presenting both formal and informal instruction in basic military subjects. Favorable results along these lines have been achieved.

A second and corollary problem resulting from the shortened advanced course at M.I.T. has been the difficulty experienced by many R.O.T.C. students in making the abrupt transition from informal campus life to the more rigorous and demanding standards of the Army environment at R.O.T.C. camps and later as second lieutenants on active duty in the Army. While some slight progress has been made in the past year in bridging this gap much

remains to be done in improving the appearance and military courtesy of the cadets during R.O.T.C. instruction.

CHARLES M. MCAFEE, JR.

Placement Officer

The report on student placement has been prepared by Mr. Philip A. Stoddard, Associate Placement Officer in charge of the Student Placement Bureau. Mr. Stoddard assumed this position during the past year, taking over the direction of the office from Professor Carlton E. Tucker who has handled its direction so expertly for the past several years. The report on alumni placement has been prepared by Mrs. James A. Yates, under whose direction that office operates.

Student Placement. During the past year 330 employers came to the campus to conduct interviews and of this number 81 came two or more times. If affiliated companies are counted separately, the number of employing agencies considerably exceeds 400. This activity brought 588 company representatives to the campus who conducted 6,074 student interviews, an average of seven interviews for each student using the Student Placement Bureau. At least 326 other companies recruited by correspondence.

Starting salaries continued to rise, the increase being $20 to $50 per month. Holders of Bachelor's degrees averaged about $370 per month, Master's degrees about $415 and Doctor's degrees from $550 up.

Even though the recruiting activity by employers for technically trained people continued at a high level, some students found securing desirable job offers more difficult than in the past two years. Employers were more selective and placed their emphasis on quality and not quantity, so that there was a greater concentration of offers among the top half of the class. Low grades,

vagueness of goals and indifference proved serious handicaps. Many employers gave more attention to military status than in the past and graduates not facing military call were much in demand. The following table shows the placement of the September, February and June graduating classes for this year. As in the past several years, it is expected that the military outlook for many of those who have not yet received orders will be clarified by late summer.

PLACEMENT OF 1953–54 GRADUATES AS OF JULY, 1954

	Bachelor's Degree	*Master's Degree*	*Professional Degree*	*Doctor's Degree*	TOTAL
Civilian employment	40%	48%	25%	83%	47%
Armed Forces	11	10	4	—	9
Armed Forces (career officers)	—	14	57	1	8
Graduate study	26	11	8	5	17
Foreign students	4	7	4	5	6
Desire further placement assistance	2	—	—	—	1
Not Yet Reported	17	10	2	6	12

The fields of activity of the employers of those reporting civilian employment follows:

Manufacturing	56%
Education (Including research)	19
Governmental agencies	8
Engineering and architectural services	7
Construction (Including marine)	4
Communication	2
Business services	1
Other (Including mining, utilities and transportation)	3

There has been a continually growing interest on the part of employers and students in professional summer work programs. During the past year 93 employers offered this type of opportunity, and 23 of them conducted campus interviews.

Alumni Placement. This year's Alumni Placement Bureau figures are, perhaps, the most interesting we have ever presented. During a year when the newspapers and magazines have cried "recession," the number of jobs listed with this office increased by 38 per cent over the previous year and came in from forty-six states, the District of Columbia and twenty-three foreign countries. Equally interesting is the fact that the number of men who registered increased by only 5 per cent.

PLACEMENT BUREAU STATISTICS

	July, 1953 to June, 1954	*July, 1952 to June, 1953*
Number of jobs	4055	2934
Men who went on available list	770	731
Men who came off available list	659	424
Placements	168	150

Very few of the men who have been "looking around" have been unemployed, and even the unemployed men have given strong evidence of the general feeling of job security among scientists and engineers. They have placed strict limitations on this office as to where they will go, what they will do and the minimum salary they will consider. The stringent geographical limitations which are frequently placed upon us cut the effectiveness of our available list by as much as 50 per cent because it takes at least as much luck as skill to place a man within commuting distance of his home on the north side of Chicago or the south side of Boston.

Of the men who registered with us, 21.6 per cent were offered and accepted positions of which they heard through this office. Another 32 men wrote to tell us that after looking around they had decided that they were better off in their own companies. Of those 32, 27 made that decision after having been offered good new positions with other companies only to have the old company meet or better the offer. Had we called these 27 men placements, we could have pushed the percentage placed up to something over 25 per cent. In addition, 329 more were removed because we had written to ask them whether they wanted to stay on the available list and had received no reply or because mail was returned from the address we had been using. In general, about 60 per cent of the men who register keep in touch with us fairly well and notify us when they have accepted positions or have changed their minds about wanting to move. The other 40 per cent, having registered, never let us hear from them again.

During the past 12 years, M.I.T. men both old and young have become more flexible and broad-gauge human beings, able to specialize without losing their awareness of what is going on in the world around them and with a developed self-confidence and self-respect which makes them readily adaptable to new circumstances and new problems.

NATHANIEL MCL. SAGE

Registry of Guests

The responsibilities of the Massachusetts Institute of Technology as an international center for the promotion of study, research and exchange of information impose varied obligations upon its Faculty and administrative officers, including the appropriate reception of visitors. The fact that so many persons from so many areas of the globe desire to visit the Institute is a source of justifiable satisfaction, but it creates a problem of budgeting the time of our own personnel to extend hospitality without excessive infringement upon the discharge of our primary educational obligations.

No office can relieve the members of the Faculty of their obligation as hosts, but a certain degree of relief in matters of timing, reception, scheduling of appointments and information service for visitors is afforded by the office of the Registry of Guests. By ascertaining in advance the objectives of a proposed visit it is usually possible to schedule the interviews or inspections which seem likely best to meet these objectives with the minimum expenditure of time both for the visitor and for those who receive him.

In recognition of this service there is an increasing frequency and variety of referrals to this office of initial inquiries from those desiring to visit the Institute for various purposes and varying lengths of time. By preliminary correspondence it is often possible to define the objectives more precisely and to delimit the time to be devoted to their promotion.

During the past academic year, the Registry has endeavored also to maintain a record of temporary Faculty employees of alien citizenship and to extend to them the advisory services available for aliens other than foreign students.

During the year ending June 30, 1954 this office has had official cognizance of the following:

Guests of the Institute	29
Visiting Fellows	50
Visitors	947
Visiting Professors, Lecturers, etc.	172
Total	1,198

As a clearing house of information for and about visitors, this office endeavors to maintain up-to-date files on the whereabouts and the business of visiting teachers, official Guests and Visiting Fellows, as well as a record of transient visitors referred to it.

The categories of other than transient visitors are as follows:

GUEST OF THE INSTITUTE: A colleague of academic rank of full professor or of equivalent professional attainment attending the Institute for study, research or other investigations. He may share all facilities available to a staff member without academic credit, without fees and without remuneration.

VISITING FELLOW: A colleague of academic rank less than that of full professor or a person of at least equivalent professional standing, qualified for advanced study or research. He may not become a candidate for a degree but may audit lectures or engage in research without fee or, if enrolled as a special graduate student for academic credit, at specified fees; if an alien with appropriate vias, he may accept staff employment with compensation.

JOHN W. M. BUNKER

Director of the Acoustics Laboratory

The research program of the Laboratory has progressed along the same general lines reported in some detail last year. Particular attention has been focused on basic physical problems in the generation and propagation of sound and on bioacoustic interactions between sound and man.

Propagation of sound in the atmosphere has been studied in full-scale field measurements, in idealized laboratory experiments and by theoretical analysis. Sound shadows caused by wind and temperature gradients were shown to have a major influence on the distribution of sound at short ranges near the ground. The sound in the shadow is influenced to an unexpected degree by the

absorptive nature of the terrain and by the turbulent structure of the atmosphere. Considerable progress has already been made in isolating the effects produced by these several factors and in predicting their influence on sound-intensity distribution around a source. Studies of the generation, absorption and scattering of sound by mechanisms associated with turbulence and heat have made continuing progress.

An exploratory study of the applicability of correlation techniques to the measurement of complex noise sources and sound transmission through structures resulted in a Doctor's thesis and further research presently in progress. In co-operation with the American Standards Association Professor Walter A. Rosenblith, chairman of Subcommittee Z24-X-2, completed a study relating to industrial noise hazards with a report entitled "The Relations of Hearing Loss to Noise Exposure." Working closely with him in this study was Professor H. Wayne Rudmose, on leave from Southern Methodist University, who conducted a nation-wide survey of relevant information.

The inter-relationships of Laboratory activities in these several areas gained special significance in the light of increasing interest on the part of industry and government in industrial and aircraft noise, its direct effects on hearing and its intrusion into community life. As a result of the interaction between the Laboratory program and the public interest members of the staff have undertaken a number of professional activities in this area. For example, Professor Richard H. Bolt is chairman of the Armed Forces-National Research Council Committee on Hearing and Bioacoustics. He also conducted a symposium on Jet Aircraft Noise for the National Advisory Committee for Aeronautics in August and presented a paper on this subject in March before the Institute of the Aeronautical Sciences. Professor Rosenblith was appointed Consultant to the Subcommittee on Noise in Industry of the Committee on Conservation of Hearing of the American Academy of Ophthalmology and Otolaryngology. In July he and Dr. Kenneth N. Stevens participated in an exploratory study at Wright-Patterson Air Force Base on the biological effects of high intensity noise. Professor Leo L. Beranek was named Temporary Editor of a new journal, *Noise Control*, to be sponsored by the Acoustical Society of America.

The personnel of the Laboratory decreased somewhat — to about eighty persons — with increased emphasis on student participation. Fifteen student theses were completed, 32 articles published and 34 papers read before professional organizations. A textbook entitled *Acoustics* by Professor Beranek was published during the year.

In addition to continuing support from the United States Navy, Air Force, Public Health Service, National Advisory Committee for Aeronautics and Owens-Corning Fiberglas Corporation, new support was received from the Radio Corporation of America to aid in a study of the long-time-average power density spectrum of speech.

A Special Summer Program on Noise Reduction under the direction of Professor Beranek was held August 24 to September 4, 1953, attended by more than 115 engineers, physicians and industrial hygienists. An Industrial Liaison Symposium on the Effects and Control of Noise was held in April with Professor Bolt as chairman. In June a symposium on Aero-Thermoacoustics under the chairmanship of Professor Osman K. Mawardi was sponsored by the Laboratory and the Department of Electrical Engineering.

The Laboratory had the pleasure of receiving a number of foreign visitors and distinguished seminar speakers during the year. These included Dr. Wolff D. Keidel, University of Erlangen, Germany; Professor Koji Sato, Institute for Science and Technology, University of Tokyo, and President of the Acoustical Society of Japan; Professor Erwin Meyer, III, Physical Institute, Göttingen, Germany; and Professor Auguste C. Raes, Ecole Nationale Supérieure d'Architecture, Bruxelles.

Dr. Stevens, supervisor of the Laboratory's program on speech analysis and synthesis, was appointed Assistant Professor of Electrical Communications in the Department of Electrical Engineering. Dr. Robert F. Lambert, on leave of absence from the University of Minnesota, was appointed Assistant Professor in the Department of Electrical Engineering and joined the Laboratory for a year of research. Professor Mawardi concluded arrangements for a leave of absence to work at the University of Cambridge with Sir Geoffrey Taylor for the year 1954–55.

The Laboratory was pleased to announce the availability of a new fellowship sponsored by the Houdaille-Hershey Corpora-

tion. The Owens-Corning Fiberglas Corporation Fellowship was awarded to Mr. Richard K. Lyon, candidate for the Doctor's degree in physics.

At the Twenty-Fifth Anniversary Meeting of the Acoustical Society of America in June, Professor Beranek became President of the Society and Professor K. Uno Ingard received the Biennial Award for outstanding contributions to the field of acoustics.

RICHARD H. BOLT

Director of the Research Laboratory of Electronics

The research program of the Laboratory has continued actively in some areas and has been modified in others. Several projects have been completed or discontinued, and others have been initiated. A total of 45 staff members and 97 graduate students from the Departments of Physics, Electrical Engineering and Modern Languages were engaged in the research programs. In addition the Laboratory was host to three guests, visiting staff members from 16 countries and two Foreign Student Summer Program visitors.

The physics program of the Laboratory includes the nuclear resonance work of Professor Francis Bitter's magnet laboratory; the research on the properties of matter at very low temperatures directed by Professor Melvin A. Herlin; the studies of the properties of microwave gas discharges being conducted by Professors Sanborn C. Brown and William P. Allis; the microwave spectroscopy investigations conducted in Professor Malcolm W. P. Strandberg's laboratory; the work on the properties of emitting materials and the solid-state and high-vacuum research of Professor Wayne B. Nottingham and his large group of students; and the molecular beam research directed by Professor Jerrold R. Zacharias and Dr. Vincent Jaccarino.

The precise atomic frequency standard being developed under the supervision of Dr. Zacharias has shown considerable promise in preliminary tests. A stable microwave oscillator

developed for the standard by Visiting Professor James G. Yates will have numerous other applications.

A number of programs initiated last year by members of the electrical engineering Faculty are arousing widespread interest. The research on switching circuits directed by Professors Samuel H. Caldwell, David A. Huffman and William K. Linvill is yielding interesting results; the work on information theory supervised by Professors Robert M. Fano and Peter Elias has entered new areas of application; and the semi-conductor noise studies under investigation by Professors Richard B. Adler and Jerome B. Wiesner are yielding a better understanding of diode and transistor noise.

A number of continuing programs have been active during the past year. Among these are the following: research on transistor circuits and applications directed by Professors Adler, Henry J. Zimmermann, and Samuel J. Mason; network synthesis supervised by Professor Ernst A. Guillemin; microwave-tube research supervised by Messrs. Louis D. Smullin and Hermann A. Haus; research on microwave components supervised by Professors Lan J. Chu, Adler, Wiesner and Zimmermann; studies of second-order correlation directed by Professor Yuk-Wing Lee; and the electro-neurophysiology studies supervised by Professor Walter A. Rosenblith and Dr. Warren S. McCulloch.

The Meteor guidance program directed by Professor Zimmermann was concluded at the close of the academic year. An outgrowth of this work is continuing in the form of a basic study of missile guidance problems. Many of the techniques evolved in the Meteor guidance program are being applied to new problems.

As in previous years, the Laboratory continues to receive the majority of its financial support from the three military services through a joint services contract administered by the Signal Corps. In addition, special projects in the Laboratory received support from the Office of Naval Research, the Navy Bureau of Ordnance, the Air Force, Bell Laboratories, the Teagle Foundation and the Illuminating Society of America.

Support for the Research Laboratory of Electronics Industrial Fellowships was provided by the Radio Corporation of America, the Sperry Gyroscope Company, the Gabriel Company and the General Communications Company.

JEROME B. WIESNER

Director of the Division of Industrial Co-operation

The research programs administered by the Division continued at a fairly uniform volume, only a slight increase being shown over that of the previous fiscal year. For the second consecutive year there has been a healthy increase in research programs sponsored by industry and foundations. Reports covering activities within the research laboratories will, as usual, be presented by the deans to whom their departments are responsible.

The tabulation below shows the distribution of the active research projects by participating departments and interdepartmental laboratories, as of June 30, 1954:

	Government	*Industrial*	*Total*
Aeronautical Engineering	40	9	49
Biology	11	2	13
Building Engineering and Construction	2	0	2
Chemical Engineering	11	5	16
Chemistry	17	4	21
Civil and Sanitary Engineering	23	4	27
Electrical Engineering	17	2	19
Food Technology	8	0	8
Geology	5	0	5
Mathematics	9	1	10
Mechanical Engineering	30	6	36
Metallurgy	34	7	41
Meteorology	8	0	8
Physics	20	1	21
Acoustics Laboratory	4	1	5
Research Laboratory for Electronics	9	2	11
Laboratory for Nuclear Science	4	1	5
Center for International Studies	2	3	5
Dynamic Analysis and Control Laboratory	7	2	9
Servomechanism Laboratory	8	4	12
Miscellaneous	6	2	8
Totals	275	56	331

Shown below are brief tabulations reflecting the operations of the Division for the year ending June 30, 1954, and tables indicating the personnel employed on research programs, in addition to the changes in the status of projects during the fiscal year:

DOLLAR VOLUME OF D.I.C. PROJECTS

	Fiscal Years 1953–54	1952–53
General government	$16,746,500	$16,906,800
Industrial and foundations	1,308,100	922,750
Total	$18,054,600	$17,829,550

PERSONNEL EMPLOYED ON D.I.C. PROJECTS

	As of June 30, 1954	As of June 30, 1953	As of June 30, 1952
D.I.C. Staff	715	770	1,161
D.I.C. Non-Staff	1,212	1,199	1,799
M.I.T. Staff	727	680	644
Total	2,654	2,649	3,604

STATUS OF D.I.C. PROJECTS AS OF JUNE 30, 1954

	Number of Projects, June 30, 1954	New	Terminated	Number of Projects, June 30, 1953
General government	275	93	90	272
Industrial and foundation	56	26	16	46
Total	331	119*	106	318

* Does not include projects extended by contract amendment. These total 255, of which 228 are general government and 27 are industrial and foundation.

NATHANIEL MCL. SAGE

Director of the Division of Defense Laboratories

Operations of the Division of Defense Laboratories were segregated from the operations of the Division of Industrial Cooperation effective July 1, 1953. The principal work of the Division has been concerned with the Lincoln Laboratory. While the bulk of the work at Lincoln was carried on under the sponsorship of the Army, Navy and Air Force, a small segment of related work was sponsored by the Western Electric Company. A second government contract covering a study for the Departments of the Navy and Air Force was initiated late in the fiscal year but did not become operational prior to July 1, 1954.

Reports covering the operations of the Division of Defense Laboratories and a tabulation of personnel employed are set forth below:

FISCAL REPORT FOR YEAR ENDED JUNE 30, 1954

	1953–54
General government	$17,811,500
Industrial	1,295,600
Total	$19,107,100

PERSONNEL EMPLOYED ON D.D.L. PROJECTS

	1953–54
D.D.L. Staff	571
D.D.L. Non-Staff	1025
M.I.T. Staff	36
D.I.C. Staff	8
D.I.C. Non-Staff	54
Total	1694

HORACE S. FORD

Executive Vice-President of the Alumni Association

On April 30 the membership rolls of the Association included 48,671 names, a net gain of 1,436 over the preceding 12 months by the addition of 1,712 new alumni of the Class of 1953 and 112 of the Class of 1954 who graduated in February and the subtraction of the names of 388 alumni reported deceased. During the 12-month period 7,615 address changes were recorded; and on April 30 the number of alumni in the "address missing" category totalled 4,465, or 9 per cent of our roster.

At the close of the fiscal year, on June 30, the amount contributed to the 1954 Alumni Fund totalled $243,171 from 9,620 contributors. Thus the previous high mark of $213,100 attained in 1952–53 was exceeded by 14 per cent, although the number of alumni contributing was 918, or 9 per cent less than in the record year of 1947–48.

Our fourth Alumni Regional Conference, held on January 30 under the auspices of the Detroit M.I.T. Association, was attended by some 230 alumni and friends including many of the leading executives of the Detroit area. Six members of the Institute Faculty and administration addressed its sessions.

As has been the case at previous Alumni Regional Conferences, comment on the part of those attending was almost unanimously favorable as to the value such gatherings have for

participants. It is, therefore, the present intention of the Association to hold two, or possibly three, such Regional Conferences during 1954–55 under the auspices of M.I.T. clubs in other parts of the United States.

During 1953–54 two new M.I.T. Clubs have been established, one at Taiwan and the other at Sao Paulo. Since the personnel of the Taiwan Club and that of the M.I.T. Club of Hong Kong established in 1950 embraces most of the former membership of the M.I.T. Club of Shanghai, organized in 1922, the Association has declared the M.I.T. Club of Shanghai to be "inactive" for the time being.

Our present roster of these geographical alumni groups therefore totals 91. Sixty-nine M.I.T. clubs are located within the continental United States, 12 are elsewhere in the Americas and 10 are overseas in the other hemisphere. During the 12 months ended last April 54 members of the Institute staff attended 113 meetings of 61 different M.I.T. Clubs. Thus in each of the past three years over 60 M.I.T. clubs have had at least one "visitor" from Cambridge.

H. E. LOBDELL

Director of The Technology Press

The Technology Press during 1953–54 published its largest annual list to date and broadened its publication program, particularly in the social studies. The following are the year's titles:

Published by the Technology Press:

Notes on the M. I. T. Summer Course on OPERATIONS RESEARCH, by Philip M. Morse, September, 1953.

SCIENTIFIC FRENCH, by William N. Locke, February, 1954.

A CHRONOLOGICAL LIST OF PROSE FICTION IN ENGLISH PRINTED IN ENGLAND AND OTHER COUNTRIES 1475–1640, by W. H. Sterg O'Dell, March, 1954.

WHEN M. I. T. WAS "BOSTON TECH," by Samuel C. Prescott, June, 1954.

Published by The Technology Press and John Wiley & Sons, Inc.:

NATIONALISM AND SOCIAL COMMUNICATION, by Karl W. Deutsch, July, 1953.

APPLIED ELECTRONICS (second edition), by Truman S. Gray, March, 1954.

PHYSICAL METEOROLOGY, by John C. Johnson, April, 1954.

TRANSIENT ANALYSIS OF ALTERNATING CURRENT MACHINERY, by Waldo V. Lyon, June, 1954.

LABOR MOBILITY AND ECONOMIC OPPORTUNITY, essays by E. Wight Bakke, Philip M. Hauser, Gladys L. Palmer, Charles A. Myers, Dale Yoder, and Clark Kerr; preface by Paul Webbink, June, 1954.

FREDERICK G. FASSETT, JR.

Principal Honors and Awards to the Staff

ADMINISTRATION

PIETRO BELLUSCHI

Fellow, Danish Royal Academy of Fine Arts.
Trustee, American Federation of Arts.
Allied Member, National Sculpture Society.
Associate Member, National Academy of Design.

JOHN ELY BURCHARD

President of the American Academy of Arts and Sciences.
Member of the Executive Committee, Board of Trustees, Mount Holyoke College.

EDWARD LULL COCHRANE

Honorary Degree of Doctor of Engineering, Stevens Institute of Technology.

BEVERLY DUDLEY

Chairman of the Boston Section, Institute of Radio Engineers.
Co-chairman of the New England Radio Engineering Meeting.
Certificate of Excellence, American Institute of Graphic Arts.

HORACE SAYFORD FORD
Honorary Degree of Doctor of Laws, Middlebury College.

GEORGE RUSSELL HARRISON
Elliott Cresson Medal of the Franklin Institute of Pennsylvania, for "discovery, original research, or invention adding to the sum of human knowledge."
Medal of the Society for Applied Spectroscopy, for outstanding contributions to the field of spectroscopy.

JAMES RHYNE KILLIAN, JR.
Honorary Degree of Doctor of Science, University of Notre Dame.
Honorary Degree of Doctor of Science, Lowell Technological Institute.

C. RICHARD SODERBERG
Honorary Member of the American Society of Swedish Engineers.

JULIUS ADAMS STRATTON
Board of Directors of the Institute of Radio Engineers.

FACULTY AND STAFF

Department of Aeronautical Engineering

JEROME C. HUNSAKER
Godfrey L. Cabot Award of the Aero Club of New England, for outstanding contributions to aviation.

HORTON GUYFORD STEVER
Fellow, American Academy of Arts and Sciences.
Chairman of the Aircraft Armament Group, Office of the Assistant Secretary of Defense for Research and Development.

PETER HERON WINTER
Fulbright Award from Bristol University (England) for study at M. I. T.

Department of Architecture

HERBERT LYNES BECKWITH
President of the National Architectural Accrediting Board.

Department of Biology

CHARLES HENRY BLAKE
President of the North Eastern Bird-Banding Association.
Chairman of the Massachusetts Conservation Council.

MOC V. EDDS, JR.
Secretary of the Society for Study of Growth and Development.

CLAIR ELSMERE TURNER
President of the International Union for Health Education of the Public.
Prentiss National Award in Health Education.
Medal of the City of Paris.
Distinguished Service Medal, Health Educators of France.

Department of Chemical Engineering

WILLIAM H. MCADAMS
Worcester Reed Warner Medal of the American Society of Mechanical Engineers, for outstanding contributions to permanent engineering literature, particularly in the field of heat transfer.

THOMAS K. SHERWOOD
Chairman of the Publication Committee, American Institute of Chemical Engineers.
Chairman of the House Committee, American Academy of Arts and Sciences.

WALTER GORDON WHITMAN
Honorary Membership, American Institute of Chemists.
Honorary Degree of Doctor of Science, Northeastern University.
Exceptional Civilian Service Award, Department of Defense.

Department of Chemistry

NELSON JAY ANDERSON
Chairman of the Mailing Committee, New England Association of Chemistry Teachers.

AVERY ALLEN ASHDOWN
Honor Scroll of the New England Chapter of the American Institute of Chemists, "in recognition of untiring service to fellow chemists."

ARTHUR CLAY COPE
Member of the Board of Directors and of the Board Executive Committee, American Chemical Society.

DAVID NEWTON HUME
Fellowship, John Simon Guggenheim Memorial Foundation.

ARTHUR S. OBERMAYER
Fellowship, National Science Foundation.

LOCKHART B. ROGERS
National Councilor, American Chemical Society.
Chairman of the Gordon Research Conference in Analytical Chemistry.

GEORGE SCATCHARD

Theodore William Richards Medal of the Northeastern Section of the American Chemical Society, for outstanding researches in the physical chemistry of solutions.

JACINTO STEINHARDT

President of the Operations Research Society of America.

WALTER HUGO STOCKMAYER

Fellowship, John Simon Guggenheim Memorial Foundation.

C. GARDNER SWAIN

Member, American Academy of Arts and Sciences.

JOHN WIDMER WINCHESTER

Fellowship, National Science Foundation.

RALPH CHILLINGWORTH YOUNG

Advisory Board, "Inorganic Syntheses."

ETHEL M. ZAISER

Fellowship, National Cancer Institute.

City and Regional Planning

FREDERICK JOHNSTONE ADAMS

United Nations Delegate to the Regional Seminar on Housing and Community Improvement, New Delhi, India.

JOHN TASKER HOWARD

President of the American Institute of Planners.

LOUIS BEMIS WETMORE

President of the New England Chapter, American Institute of Planners.

Civil and Sanitary Engineering

JAMES WALLACE DAILY

Secretary of the Hydraulic Division, American Society of Mechanical Engineers.

WERNER H. GUMPERTZ

Chairman of the Program Committee, Northeastern Section, American Society of Civil Engineers.

ARTHUR THOMAS IPPEN

Karl Emil Hilgard Hydraulics Prize of the Hydraulics Division, American Society of Civil Engineers, for a paper judged of superior merit dealing with problems of flowing water in theory or practice.

Chairman of the Hydraulics Section, Boston Society of Civil Engineers.

Member of Council, International Association for Hydraulic Research.

Chairman of the Advisory Board, Engineering Mechanics Division, American Society of Civil Engineers.

JAN MALAN JORDAAN

Annual grant, William Smith Thomas Memorial Fund (Johannesburg, South Africa).

WILLIAM E. STANLEY

Clemens Hersche Award of the Boston Society of Civil Engineers, for paper entitled "Sewer Capacity Design Practice."

DONALD WOOD TAYLOR

Vice-President of the Boston Society of Civil Engineers.

JOHN BENSON WILBUR

President of the Northeastern Section, American Society of Civil Engineers.
Member of the Board of Government, Boston Society of Civil Engineers.

Department of Economics

HAROLD ADOLPH FREEMAN

Associate Editor, Journal of American Statistical Association.

JOSEPH CARL ROBNETT LICKLIDER

Chairman of the Committee on Membership, Acoustical Society of America.
Chairman of the Committee on Speech Communication, Acoustical Society of America.
Fellow, American Academy of Arts and Sciences.

NORMAN J. PADELFORD

Fulbright Award for study in France.
Trustee of Denison University.

Department of Electrical Engineering

CHARLES WILLIAM ADAMS

Chairman of the Joint Computer Committee, American Institute of Electrical Engineers, Institute of Radio Engineers, and Association for Computing Machinery.
Council Member, Association for Computing Machinery.

LEO LEROY BERANEK

Temporary Editor of *Noise Control*.
President-Elect of the Acoustical Society of America.

MARY A. B. BRAZIER

President of the American Electroencephalographic Society.
Treasurer of the International Federation of Societies for Electroencephalography.

ROBERT MARIO FANO

Director of the Boston Section, Society for Industrial and Applied Mathematics.
Fellow, Institute of Radio Engineers.

TRUMAN STRETCHER GRAY

Acting Chairman of the Boston Chapter, Professional Group on Nuclear Science, Institute of Radio Engineers.

Member of the Executive Committee, Boston Section, Institute of Radio Engineers.

EARL WILLIAM KELLER

Member of the Executive Committee, Boston Section, Institute of Radio Engineers.

SAMUEL JEFFERSON MASON

Vice-Chairman of the Circuit Theory Committee, Institute of Radio Engineers.

Issue Editor, Professional Group on Circuit Theory, Institute of Radio Engineers.

OSMAN KAMEL MAWARDI

Member of the Committee of Hearing and Biological Acoustics, National Research Council.

GEORGE CHENEY NEWTON, JR.

Louis E. Levy Medal of the Franklin Institute of Pennsylvania, "in recognition of his outstanding paper 'Compensation of Feedback Control Systems Subject to Saturation.' "

CHARLES ALFRED POWEL

Trustee of the Volta Scholarship, American Institute of Electrical Engineers.

Chairman of the Members-for-Life Fund, American Institute of Electrical Engineers.

WILLIAM HENRY RADFORD

Member of the Special Commission on Educational Television, Commonwealth of Massachusetts.

Member of the Massachusetts Board of Educational Television.

Fellow, Institute of Radio Engineers.

WALTER ALTER ROSENBLITH

Chairman of Exploratory Subcommittee Z24-X-2, American Standards Association.

MAGNUS INGVALD SMEDAL

Treasurer of the New England Roentgen Ray Society.

Department of Food Technology

FELIX I. BRONNER

Chairman of the Gordon Research Conference on the Structure, Chemistry and Physiology of Teeth and Bones.

SAMUEL ABRAHAM GOLDBLITH

Associate Editor, *Food Technology*.

Monsanto Presentation Award of the Institute of Food Technologists, for the best organized and best delivered paper presented before the 13th Annual Convention of the Institute of Food Technologists.

ERNEST E. LOCKHART

Vice-Chairman of the Northeast Section, Institute of Food Technologists.

Department of Geology and Geophysics

MARTIN JULIAN BUERGER

Foreign Member, Academy of Sciences of Torino, Italy.

HAROLD WILLIAMS FAIRBAIRN

Editor of the Tectonophysics Section, American Geophysical Union.

PATRICK M. HURLEY

Fellow, American Academy of Arts and Sciences.

Department of Graphics

DOUGLAS PAYNE ADAMS

Visiting Lecturer in Applied Science, Harvard University.

Department of Humanities

CARVEL COLLINS

Chairman of the Literature and Psychology Group, Modern Language Association.

KARL WOLFGANG DEUTSCH

Fellowship, John Simon Guggenheim Memorial Foundation.

Visiting Professor of Political Science, University of Chicago.

Visiting Professor in Research, Center for Research on World Political Institutions, Princeton University.

Member, Bicentennial Conference on Federation, Columbia University.

JOHN BELL RAE

Editorial Board, Business History Review.

School of Industrial Management

EDWARD HARRY BOWMAN

Member of the Executive Committee, Boston Chapter, American Society for Quality Control.

WILLIAM VAN ALAN CLARK, JR.

Member of the Board of Directors, Boston Chapter, Society for the Advancement of Management.

Vice-Chairman of the National College-Industry Committee on Materials Handling Education.

Ross MacDuffee Cunningham

Certificate of Teaching Merit in Marketing Research of the Market Research Council.

Thomas Mason Hill

Chairman of the Committee on Concepts and Standards, American Accounting Association.

William A. W. Krebs, Jr.

Executive Secretary, New England Committee on Atomic Energy.

Joseph A. Pechman

Member of the Executive Committee, Conference on Research in Income and Wealth.

Albert Harold Rubenstein

Fulbright Award for study in Norway.

Fellowship, College-Business Exchange Program, Hercules Powder Co.

Erwin Haskell Schell

Honorary Counselor, Comité Internationale Organization Scientifique.

Eli Shapiro

Fellowship, Summer Institute in Mathematics for Social Scientists, Social Science Research Council.

Mason Smith

Chairman of the Research Committee, National Association of Cost Accountants.

Lybrand Award for paper published by National Association of Cost Accountants.

Thomas Arthur Staudt

National Award of the American Marketing Association for "a significant contribution to the advancement of science in marketing."

Department of Mathematics

Norman Levinson

Bocher Prize of the American Mathematical Society, for "notable research in analysis."

Member of the Mathematics Division, National Research Council.

Chia-Chiao Lin

Fellowship, John Simon Guggenheim Memorial Foundation.

William Ted Martin

Managing Editor, *Bulletin of the American Mathematical Society.*

LEE A. SEGEL
Fulbright Award for study at Cambridge University, England.

GEORGE W. WHITEHEAD
Fellow, American Academy of Arts and Sciences.

Department of Mechanical Engineering

PETER ASHURKOFF
Charles T. Main Award of the American Society of Mechanical Engineers, for a paper on the influence of the engineering profession on public life.

JACK BARTLEY CHADDOCK
Second Vice-Chairman of the Boston Section, American Society of Refrigerating Engineers.

JACOB PIETER DEN HARTOG
Fellow, American Society of Mechanical Engineers.

I-MING FENG
Walter D. Hodson Award of the American Society of Lubrication Engineers, for a paper entitled "Lubricating Properties of Molybdenum Disulfide."

AUGUST LUDWIG HESSELSCHWERDT, JR.
National Director, American Society of Refrigerating Engineers.

WILLIAM MACGREGOR MURRAY
Secretary-Treasurer of the Society for Experimental Stress Analysis.

HENRY MARTYN PAYNTER
Alfred Noble Prize, a joint award of the engineering societies "for a technical paper of exceptional merit" by a young engineer.

BRANDON GARNER RIGHTMIRE
Chairman of the Boston Section, American Society of Lubrication Engineers.

WARREN M. ROHSENOW
Member of the Executive Committee, Boston Section, American Society of Mechanical Engineers.

PETER KOLOMAN STEIN
Secretary of the New England Section, Society for Experimental Stress Analysis.
Secretary of the Program Committee, Boston Section, American Society of Mechanical Engineers.

C. FAYETTE TAYLOR
Certificate of Honor of the American Society of Mechanical Engineers, for paper entitled "Heat Transmission in Internal-Combustion Engines."
Certificate of the Society of Automotive Engineers, for 35 years' active membership.

AUSTIN WHILLIER
Karl Taylor Compton Prize.

Medical Department

DANA LYDA FARNSWORTH
President of the American College Health Association.
Chairman of the Fourth National Conference on Health in Colleges.

PRESTON K. MUNTER
Commonwealth Fund Fellowship for Graduate Study in Psychiatry.

Department of Metallurgy

JOHN CHIPMAN
Trustee of the Foundation for Education and Research, American Society for Metals.
Member of the Board of Governors, *Acta Metallurgica.*

MORRIS COHEN
American Society for Metals Visiting Lectureship, Illinois Institute of Technology.
Chairman of the Boston Chapter, American Society for Metals.
Mathewson Gold Medal of the American Institute of Mining and Metallurgical Engineers, for a paper "representing the most notable contribution to metallurgical science."
Director, American Institute of Mining and Metallurgical Engineers.

PHILIP LOUIS DEBRUYN
Secretary-Treasurer of the Boston Chapter, American Institute of Metallurgical Engineers.

ANTOINE MARC GAUDIN
Member of the Board, Engineering Foundation.
Chairman of the Research Procedure Committee, Engineering Foundation.
Official guest of the Government of Brazil, as consultant to the National Research Council of Brazil and lecturer on ore treatment.

NICHOLAS JOHN GRANT
Vice-Chairman of Boston Chapter, American Institute of Metallurgical Engineers.
Technical Adviser and Associate Member, Investment Castings Institute.

WILLIAM DAVID KINGERY
Secretary of the New England Section, American Ceramic Society.
Secretary of the Basic Science Division, American Ceramic Society.
Ross Coffin Purdy Award of the American Ceramic Society, "in recognition of his outstanding contribution to ceramic literature in the year 1952."

FREDERICK H. NORTON
Honorary Degree of Doctor of Science, University of Toledo.

DEMETRIUS NICHOLAS TRIADIS
Chrysoverges Prize of the National Technical University, Athens, Greece.

HARRY UDIN
Co-Chairman of the Educational Committee, American Welding Society.

HERBERT HENRY UHLIG
Vice-President of the Electrochemical Society, Inc.

CARL WILHELM WAGNER
Divisional Editor (Theoretical Electrochemistry), *Journal of the Electrochemical Society.*

Department of Meteorology

DON GENE FRIEDMAN
Rockefeller Foundation Fellowship for study at the University of Chicago.

Department of Military Science

DOUTHIT L. FURCHES
Soldier's Medal for Valor.

Department of Modern Languages

WILLIAM NASH LOCKE
Regional Representative for New England, American Association of Teachers of French.

CAROL SCHATZ
Chairman of the Experimental Phonetics Section, Modern Language Association.
Augustus Anson Whitney Fellowship for study at Radcliffe College.

Department of Naval Architecture and Marine Engineering

J. HARVEY EVANS
Chairman of the New England Section, Society of Naval Architects and Marine Engineers.

SHANNON CURTIS POWELL
Chairman of the Committee on Sections, Society of Naval Architects and Marine Engineers.
Member of the Executive Committee, Society of Naval Architects and Marine Engineers.

LAURENS TROOST
Medal of Honor for Engineering and Naval Architecture of the Royal Netherlands Institute of Engineers.

Department of Physics

ROBERT LOUIS BARRINGER
Goodwin Medal.

RICHARD HENRY BOLT
Senior Member, Institute of Radio Engineers.

SANBORN CONNER BROWN
Fellow, American Academy of Arts and Sciences.

WILLIAM WEBER BUECHNER
Doctor Honoris Causa, University of Mexico.
Fellow, American Academy of Arts and Sciences.

HERMAN FESHBACH
Fellow, American Academy of Arts and Sciences.
Fellowship, John Simon Guggenheim Memorial Foundation.

CLARK GOODMAN
Fulbright Award for lectures in Japan.

THEODOR F. HUETER
Research Fellow, Massachusetts General Hospital.

KARL UNO INGARD
Biennial Award of the Acoustical Society of America, in recognition of outstanding contributions to the science of acoustics.

M. STANLEY LIVINGSTON
Chairman, Federation of American Scientists.

JEROME WILLIAM RIESE
Fellowship, National Science Foundation.

DIVISION OF DEFENSE LABORATORIES

DAVID RANDOLPH BROWN
Chairman of the Boston Chapter, Professional Group on Electronic Computers, Institute of Radio Engineers.
Vice-Chairman of the Electronic Computers Committee, Institute of Radio Engineers.

BERNARD J. DRISCOLL
Exceptional Civilian Service Award of the United States Air Force, for duty with the Scientific Advisory Board to the Chief of Staff, U.S.A.F.

DAVID L. FALKOFF
Associate Editor, *American Journal of Physics*.

JAY WRIGHT FORRESTER
Honorary Degree of Doctor of Engineering, University of Nebraska.

ELAINE H. KEITH
Recording Secretary of the Boston Chapter, Society of Women Engineers.

GEORGE FRED KOSTER
Fellowship, John Simon Guggenheim Memorial Foundation.

ARTHUR L. LOEB
Research appointment to the University of Utrecht, Netherlands.

CHALONER BERRY SLADE
Visiting Lecturer, Harvard University.

FRANCIS E. VINAL
Vice-Chairman of the New England Section, American Ceramic Society.

DIVISION OF INDUSTRIAL CO-OPERATION

JOHN F. BLACKBURN
Honorary Award of the Machine Design Division, American Society of Mechanical Engineers, for a series of papers entitled "Contributions to Hydraulic Control."

JOHN ALEXANDER KESSLER
Chairman of the Boston Chapter, Professional Group on Audio, Institute of Radio Engineers.

HARRIET PAULINE ROTH
Medal of Honorable Mention at the American Society for Metals Metallographic Exhibit, National Metal Exposition.

JOHN ERWIN WARD
Chairman of Technical Committee 26 on Feedback Control Systems, Institute of Radio Engineers.

ETHEL M. ZAISER
Fellowship, National Cancer Institute.

Publications from the Institute

Periodical Publications, Books and Reviews by the Staff

Department of Aeronautical Engineering

ASHLEY, HOLT, H. M. Voss and G. ZARTARIAN. The Dynamic Analysis of Low-Aspect-Ratio Airplane Wings. *Nat. Acad. Sci. Proc.* 40, p. 388, June, 1954.

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HUNSAKER, JEROME C. Elmer Ambrose Sperry 1860–1930. *Nat. Acad. Sci. Biographical Memoirs* 28, pp. 223–260, 1954.

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TRILLING, LEON. The Boundary Layer on a Quarter Infinite Flat Plate. *Quarterly Appl. Math.* 12, pp. 80–83, April, 1954.

VOSS, HERBERT M. and G. ZARTARIAN. On the Evaluation of the Function f. *J. Aero. Sci.* 20, pp. 781–782, November, 1953.

Department of Architecture

ANDERSON, LAWRENCE B. Variables Affecting Solar Incidence. (In *Space Heating with Solar Energy*, Proceeding of a Course-Symposium, M.I.T., August, 1950; edited by Richard W. Hamilton, pp. 17–24. Cambridge: M.I.T. [Bemis Foundation] 1954.)

ANDERSON, LAWRENCE B. Architectural Problems. (In *Space Heating with Solar Energy*, Proceedings of a Course-Symposium, M.I.T., August, 1950; edited by Richard W. Hamilton. pp. 108–116. Cambridge: M.I.T. [Bemis Foundation) 1954.]

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Department of Biology

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BLAKE, CHARLES H. An Overall Analysis of Return Rates. *Bird-Banding*, 24, pp. 144–146, October, 1953.

BLAKE, CHARLES H. Review of *Hybridization in the Purple Grackle, Quiscalus quiscula* by Charles E. Huntington. *Bird-Banding*, 24, pp. 168–169, October, 1953.

BLAKE, CHARLES H. Leg Sizes and Band Sizes; First Report. *Bird-Banding*, 25, pp. 11–16, January, 1954.

BLAKE, CHARLES H. Leg Color of Blackpoll and Bay-breasted Warblers. *Bird-Banding*, 25, p. 16, January, 1954.

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FLAKS, JOEL G. and JOHN M. BUCHANAN. The Enzymatic Formation of 4-Amino-5-Imidazole-Carboxamide Ribotide from Inosinic Acid. *Am. Chem. Soc. J.* 76, pp. 2275–2276, April 20, 1954.

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HALL, CECIL E. Measurements of Electron Scattering with the Electron Microscope. In U. S. Standards, Nat. Bur. *Electron Physics;* Proceeding of the NBS Semi-centennial Symposium. . . . November 5–7, 1951, pp. 95–100. Washington, D. C.: Govt. Print. Office, 1954. (U. S. Standards, Nat. Bur. of Circular 527.)

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JENERICK, HOWARD P. Muscle Membrane Potential, Resistance, and External Potassium Chloride. *J. Cellular & Comp. Physiol.* 42, pp. 427–448, December, 1953.

KOLTUN, WALTER L., D. F. WAUGH and R. S. BEAR. An X-Ray Diffraction Investigation of Selected Types of Insulin Fibrils. *Am. Chem. Soc. J.* 76, pp. 413–417, January 20, 1954.

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LION, KURT S. and G. F. VANDERSCHMIDT. Photographic Effects of Counter Discharges. *Tech. Rept.* 1, May, 1953.

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*Publications of the Departments and Laboratories**

DEPARTMENT OF AERONAUTICAL ENGINEERING

Aeroelastic and Structures Research Laboratory

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Lift and Moment Growths on a Swept, Tapered, Rigid Wing Upon Entering a Gust, by F. O. Carta, T. H. H. Pian and H. Lin. Report Number 32.9, June, 1953.

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An Analogue Study of Nonsymmetrical Landing and Taxiing Loads on a Rational Formulation of the Symmetrical Spin-up Loads Problem, by T. F. O'Brien and M. Ayvazian. Report Number 32.17, April, 1954.

* Copies of all reports listed have been deposited in the M.I.T. Library where they may be consulted. Microfilm or photoprint copies may be obtained through the Microreproduction Service, Charles Hayden Memorial Library. Inquiries or orders should contain the complete reference including all information printed for each title.

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Flight Control Laboratory

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Instrumentation Laboratory

A PROGRAM FOR TRANSLATION OF MATHEMATICAL EQUATIONS FOR WHIRLWIND I, by J. H. Laning, Jr., and Neal Zierler. Report Number E-364, January, 1954.

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AN ALL-ELECTRONIC HIGH-SPEED MULTIPLIER, by Sam Giser. Report Number R-67, November, 1953.

KINEMATIC AND GEOMETRIC RELATIONS ASSOCIATED WITH MOTION OF A VEHICLE OVER THE EARTH, by E. Weiss. Report Number R-68 and Supplement E-383, March, 1954.

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* In conjunction with the Department of Metallurgy.

A Note on the Simulation of Several Non-Linear Operations, by S. Giser and A. Lange. Report Number R-75, June, 1954.

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Naval Supersonic Laboratory

An Experimental Investigation of Flat Plate Heat Transfer Coefficients at Mach Numbers of 2, 2.5 and 3 for a Surface Temperature to Stream Total Temperature Ratio of 1.18, by R. H. Shoulberg, R. E. Kendall, M. Finston, J. R. Baron, F. H. Durgin and J. Kaye. Report Number 39, July, 1953.

A Brief Summary of Test Section Calibration Data Obtained in the Naval Supersonic Laboratory Wind Tunnel, by J. R. Baron. Report Number 59, December, 1953.

Survey of the Present Status of Supersonic Heat Transfer, by M. Finston. Report Number 62, June, 1954.

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Supersonic Heat Transfer Coefficients for Engineering Use, by J. A. F. Hill. Informal Memorandum A & R 110, February, 1954.

DEPARTMENT OF ARCHITECTURE

Albert Farwell Bemis Foundation

Space Heating with Solar Energy, edited by Richard W. Hamilton, notes by Austin Whillier. 1954.

Information on the technical fundamentals, engineering design and over-all problems of solar heating.

International Bibliography of Prefabricated Housing, by Phyllis M. Kelly and Caroline Shillaber. 1954. Literature available in different languages for countries which produce or make use of prefabricated housing.

Design of Residences for Climatic Comfort, by Thomas Vietorisz. June, 1954. Technical, economic and design considerations involved in the climate control of houses and similar small structures; the interrelationship of these considerations and their effect on ultimate design.

* In conjunction with the Department of Metallurgy.

Laboratory of Lighting Design

PROGRESS REPORT, Number 2, July, 1954.

Initial results of a brightness contrast study, new facilities for studying daylighting and other activities associated with the project.

DEPARTMENT OF BIOLOGY

Laboratory of Applied Biophysics

ELEMENTS OF INSTRUMENTATION: I. MATHEMATICALLY OPERATING ELEMENTS, by K. S. Lion and R. A. Davis. Technical Report Number 2, June, 1954.

DEPARTMENT OF CHEMICAL ENGINEERING

Fuels Research Laboratory, M.I.T. Combustion Research Installation (Project Squid)

HIGH OUTPUT COMBUSTION, by Hoyt C. Hottel and G. C. Williams. October 1, 1953, and April 1, 1954.

Two contributions to progress reports of Project Squid, reporting an investigation of the mechanisms involved in the preparation of fuel-oxidant mixtures for burning, the stabilization and propagation of flame through these mixtures in high-capacity combustion systems and the design of instrumentation peculiar to combustion research.

Hydrogen Peroxide Research

THE VISCOSITY OF VAPOR MIXTURES OF HYDROGEN PEROXIDE AND WATER, by C. N. Satterfield, R. L. Wentworth and S. T. Demetriades. Report Number 39, August, 1953.

KINETICS OF THE INITIAL REACTION BETWEEN AN ALDEHYDE AND HYDROGEN PEROXIDE IN AQUEOUS SOLUTION, by C. N. Satterfield and L. C. Case. Report Number 40, August, 1953.

THE SYSTEM CALCIUM PEROXIDE — CALCIUM OXIDE — OXYGEN, by C. N. Satterfield and T. W. Stein. Report Number 41, September, 1953.

HYDROGEN PEROXIDE, by W. C. Schumb, C. N. Satterfield, and R. L. Wentworth. PART I, Report Number 42, September, 1953; PART II, Report Number 43, December, 1953; PART IV, Report Number 45, November, 1953.

THE ROLE OF PROPYLENE IN THE PARTIAL OXIDATION OF PROPANE, by C. N. Satterfield and R. C. Reid. Report Number 46, May, 1954.

DEPARTMENT OF CIVIL AND SANITARY ENGINEERING

Building Engineering and Construction

STRESS RELAXATION BEHAVIOR OF REPRESENTATIVE POLYMERS; MECHANICAL BEHAVIOR OF PLASTICS MATERIALS UNDER VERY HIGH RATES OF LOADING; MECHANICAL BEHAVIOR AND ENERGY ABSORBING CHARACTERISTICS OF THIN, FLEXIBLE PLASTIC FILMS; REINFORCED PLASTICS AND INSTRUMENTATION, by Albert G. H.

Dietz and Frederick J. McGarry. Bi-monthly Progress Reports. Special Reports: April and June, 1954.

THE DETERIORATION OF ADHESIVES, by Albert G. H. Dietz and DeWitt R. Petterson. Final Report, February, 1954.

Study of non-biological factors responsible for the deterioration of metal-to-metal adhesive joints composed of synthetic resins. A non-destructive vibratory-type test was developed to follow deterioration in such adhesive-adherend systems as caused by thermal degradation.

INVESTIGATION OF INTERNAL STRESSES AND TEMPERATURES IN RADIANTLY HEATED CONCRETE SLABS, by Walter C. Voss, James A. Murray, Albert J. O'Neill and David M. Berg. Progress Report Number 2, May, 1954.

REPORT ON NATIONAL LIME ASSOCIATION FELLOWSHIP ON FUNDAMENTAL RESEARCH ON LIME AT M.I.T., 1953–54, by James A. Murray, Herman C. Fischer and Leonard S. Rolnick. May, 1954.

METHODS OF TESTING THE MECHANICAL PROPERTIES OF PROPELLANTS, by Albert G. H. Dietz, Frederick J. McGarry and James Dorsey. Final summary report, May, 1954.

The development of methods and techniques for observing the strength characteristics of plastic and plastic-like materials under very high rates of loading; specifically, stress-strain-time curves of such materials in tension were derived from the apparatus developed and built.

Hydrodynamics Laboratory

RESISTANCE COEFFICIENTS FOR ACCELERATED FLOW THROUGH ORIFICES, by James W. Daily and Wilbur L. Hankey, Jr. Technical Report Number 10, October, 1953.

CHARACTERISTICS OF VARIOUS CHECK AND ANGLE STOP VALVES IN AN EIGHT-INCH WATER LINE, by Allan T. Gifford, R. E. Nece and R. E. Dubois. Technical Report Number 5, August, 1953.

WATER TABLE EXPERIMENTS ON TRANSIENT SHOCK WAVE DIFFRACTION. PART I: OPERATION, INSTRUMENTATION AND PRELIMINARY EXPERIMENTS, by D. R. F. Harleman and O. A. Boedtker. Technical Report Number 12, August, 1953.

*Joint Highway Research Project**

THIRD ANNUAL REPORT, June, 1954.

REVERE RESURFACING PROJECT, by A. J. Bone and L. W. Crump. Progress Report Number 1, June, 1954.

An experiment in control of reflection cracking in bituminous surfaces over concrete pavement.

PRESTRESSED CONCRETE: EFFECTS OF BOND AND SUPPLEMENTARY STEEL IN BEAMS WITH POST-TENSIONED STRAND REINFORCEMENT, by J. Adjelian. Research Report Number 7, June, 1954.

* See also listing under Soil Stabilization Laboratory.

Sanitary Engineering Laboratories

A STUDY OF THE BIOCHEMICAL CHARACTERISTICS OF SYNTHETIC DETERGENTS. Progress Report Number 2, 1953.

A STUDY OF THE LIME-SODA SOFTENING PROCESS AS A METHOD FOR DECONTAMINATING RADIOACTIVE WATER, by Robert F. McCauley, R. A. Lauderdale and Rolf Eliassen. A. E. C. Report Number NYO 4439, September 1, 1953.

Soil Mechanics

THE BEHAVIOR OF SOILS UNDER DYNAMIC LOADING: INTERIM REPORT ON WAVE PROPAGATION AND STRAIN-RATE EFFECT, by R. V. Whitman and assistants. Report Number 2, July, 1953.

The purpose of the project was to develop apparatus and conduct tests to obtain fundamental information concerning the behavior of soils under transient loadings.

Soil Stabilization Laboratory

SOIL STABILIZATION FOR HIGHWAYS, by C. N. Baker, Jr. Joint Highway Research Project, Report Number 9.

Summarizes research in soil stabilization for highways for the year ending June 30, 1954.

DEPARTMENT OF ECONOMICS AND SOCIAL SCIENCE

Industrial Relations Section

SIXTEENTH ANNUAL REPORT, October, 1953.

DEPARTMENT OF ELECTRICAL ENGINEERING

Electric Machinery Laboratory

STUDY AND DETERMINATION OF OPTIMUM EXCITATION AND VOLTAGE CONTROL SYSTEMS FOR A-C GENERATORS. A. F. Technical Report Number 6652, September 30, 1953.

GENERAL SPECIFICATIONS FOR GENERATOR AND REGULATOR AIRCRAFT ALTERNATING CURRENT. Interim Engineering Reports Numbers 1 (October, 1953), 2 (January, 1954) and 3 (April, 1954).

High Voltage Research Laboratory

STERILIZATION OF BLOOD PLASMA AND FRACTIONS WITH HIGH-ENERGY ELECTRONS, by John G. Trump and Kenneth A. Wright. Progress Report to National Institutes of Health, U. S. Public Health Service, July, 1953.

ABSORPTION OF GASES AND POLYVINYLACETATE VAPORS BY EVAPORATED BARIUM, by R. W. Cloud and S. Philp. December, 1953.

DESIGN OF HAIRPIN FILAMENTS FOR LONGER LIFE, by Robert W. Cloud. April, 1954.

SPARK GAPS BETWEEN SECTIONS OF A HALF-PITCH TUBE, by Elias Gyftopoulos. July, 1954.

Laboratory for Insulation Research

PROGRESS REPORTS: NUMBER XIII, June, 1953; NUMBER XIV, December, 1953; NUMBER XV, June, 1954.

MAGNETIC AND ELECTRIC PROPERTIES OF MAGNETITE AT LOW TEMPERATURES, by B. A. Calhoun. Technical Report Number 68, July, 1953.

THE CRYSTAL STRUCTURE OF BARIUM TETRASULFIDE MONOHYDRATE, by S. C. Abrahams. Technical Report Number 70, September, 1953.

A KINETIC APPROACH TO COLLISION PROCESSES IN GASES: I. SMALL AMPLITUDE PROCESSES IN CHARGED AND NEUTRAL ONE-COMPONENT SYSTEMS, by P. L. Bhatnager, E. P. Gross and M. Krook. Technical Report Number 69, September, 1953.

DERIVATION OF ATOMIC CO-ORDINATES IN HELICAL STRUCTURES, by H. J. Grenville-Wells. Technical Report Number 71, September, 1953.

A SINGLE-CRYSTAL ADAPTOR FOR THE NORELCO HIGH-ANGLE DIFFRACTOMETER, by S. C. Abrahams and H. J. Grenville-Wells. Technical Report Number 72, September, 1953.

A REGULATED CONTROL SYSTEM FOR A LARGE ELECTROMAGNET, by L. E. Johnson. Technical Report Number 73, September, 1953.

EFFECT OF A TWO-DIMENSIONAL PRESSURE ON THE CURIE POINT OF BARIUM TITANATE, by P. W. Forsbergh, Jr. Technical Report Number 74, October, 1953.

THE CRYSTAL STRUCTURE OF DI-P-TOLYL TELLURIDE, by W. R. Blackmore and S. C. Abrahams. Technical Report Number 75, May, 1954; Number 76, May, 1954; and Number 77, May, 1954.

A STUDY ON MAGNETIC CERAMICS, by George Economos. Technical Report Number 78, May, 1954.

SHAPE OF COLLISION-BROADENED SPECTRAL LINES, by E. P. Gross. Technical Report Number 79, May, 1954.

Servomechanisms Laboratory

DESIGN CRITERIA FOR LOW-LEVEL SECOND-HARMONIC MAGNETIC MODULATORS, by Earl Justin Kletsky. Technical Report Number 1, Electronic Nuclear Instrumentation Group.

DESIGN OF AN EIGHT-POLE MAGNETIC-MATRIX SWITCH, by John W. Brean. Report Number 6506-ER-45, July, 1953.

MODULATION AND DEMODULATION WITH SEMICONDUCTORS, by Dale P. Masher. Technical Report Number 2, Electronic Nuclear Instrumentation Group.

BIBLIOGRAPHY ON DATA STORAGE AND RECORDING, compiled by G. L. Hollander. Memorandum Number 8, February, 1953.

A MODIFIED CINE SPECIAL-II CAMERA FOR IN-AIR TRACKING MEASUREMENTS, by Richard Shaw, Jr. Report Number 6506-ER-47, September, 1953.

Comparison of Two High-Power Servo Brakes, by James Jursik. Report Number 6506-ER-48, September, 1953.

A Mistake Diagnosis Routine for Whirlwind I Programs, by Douglas T. Ross. Report Number 7138-R-1, November, 1953.

A Series Method of Calculating Servomechanism Transient Response from the Frequency Response, by David V. Stallard. Report Number 7138-R-2, November, 1953.

A Recorder Using a Hydraulic Drive, by Elliott Cutting. Technical Memorandum Number 6897-TM-13, December, 1953.

Annual Progress Report, Electronic Nuclear Instrumentation Group. March 1, 1954.

Design Study of a Digital Data-Recorder for Dense Storage of Continuous Voltages, by Gerhard L. Hollander and Thomas P. Sifferlen. Engineering Report Number 6897–ER–6, April, 1954.

A Simple Method for Calculating the Time Response of a System to an Arbitrary Input, by George Biernson. Report Number 7138-R-3, January, 1954.

Nonlinear Control of a Saturating Third-Order Servomechanism, by John L. Preston. Technical Memorandum Number 6897-TM-14, May, 1954.

A Static-Magnetic Data-Storage Unit, by Richard H. Fuller. Engineering Report Number 9, May, 1954.

Investigation of a Dual-Mode Damper Stabilized Servo, by James Jursik. Report Number 7138-R-4, May, 1954.

Improved Computational Techniques for Fourier Transformation, by Douglas T. Ross. Report Number 7138-R-5, June, 1954.

Comparison of Three Basic Types of Compensation, by George A. Biernson. Engineering Memorandum Number 6506-EM-27, June, 1953.

Whirlwind I Routines for Computations for the M.I.T. Numerically Controlled Milling Machine, by John H. Runyon. Engineering Report Number 8-6873. December, 1953.

DEPARTMENT OF FOOD TECHNOLOGY

Quarterly Progress Report to the Atomic Energy Commission, by B. E. Proctor and S. A. Goldblith. Number NYO 3341, October, 1953.

A theoretical consideration of non-uniform distribution of ionizing density, and preliminary studies reported on relative bactericidal effects of high-energy gamma, X- and cathode rays on several species of bacteria as related to thickness and volume of sample, atmosphere and medium in which organism is suspended.

Bactericidal Effects of Ionizing Radiations as Influenced by Different Conditions of Atmosphere, Medium and Physical State in Which Samples are Irradiated, by B. E. Proctor and S. A. Goldblith. Quarterly

Progress Report to A. E. C., Number NYO 3342, serial number 194, January, 1954.

QUARTERLY PROGRESS REPORT TO A. E. C., by B. E. Proctor and S. A. Goldblith. Number NYO 3343, serial number 199, April 1, 1954.

Continuation of studies of bactericidal effects of ionizing radiations as influenced by different conditions of atmosphere, medium and physical state in which samples are irradiated. Initiation of study on possibility of using silver-activated phosphate glass as a dosimeter for high intensity sources of gamma rays and cathode rays.

BACTERICIDAL EFFECTS OF IONIZING RADIATIONS ON E. *coli*, B. *Thermoacidurans* AND Cl. *Sporogenes* AS INFLUENCED BY DIFFERENT CONDITIONS OF ATMOSPHERE, MEDIUM AND PHYSICAL STATE IN WHICH SAMPLES ARE IRRADIATED, by B. E. Proctor and S. A. Goldblith. Final Report to A. E. C., Number NYO 3344, serial number 217, June, 1954.

POSSIBILITY OF UTILIZING HIGH-ENERGY CATHODE RAYS FOR THE PRESERVATION AND/OR COMPLETE STERILIZATION OF WHOLE AND SLICED FRESH FRUITS, VEGETABLES AND MEATS, TO INCREASE PRESENT STORAGE LIFE OF THESE COMMODITIES, by B. E. Proctor, J. T. R. Nickerson and S. A. Goldblith. Final Report to U. S. Navy Bureau of Supplies and Accounts, Serial number 216, May, 1954.

The doses of cathode rays necessary for sterilization of certain vegetables, meats and meat products; the maximum cathode ray doses that may be applied to certain products without appreciably affecting flavor; the effects of addition of free-radical acceptors to prevent undesirable off-flavors caused by irradiation; the effect of cathode rays on inactivation of enzymes in foods.

THE APPLICATION OF ELECTRONIC TREATMENTS TO DESTRUCTION OF INSECTS IN PACKAGED MILITARY RATIONS AND PACKAGING MATERIALS, by B. E. Proctor, E. E. Lockhart and S. A. Goldblith. Final Report to the Quartermaster Food and Container Institute, serial number 186, January, 1954.

Gamma, cathode and X-rays can be lethal to all metamorphic forms of insects, sterilize adults, prevent eggs from hatching and prevent larvae and pupae from undergoing metamorphosis. No detectable changes in flavor and appearance of ration components and in the packaging materials studied were produced by irradiation at levels required for insect destruction.

DEPARTMENT OF GEOLOGY AND GEOPHYSICS

Crystallographic Laboratory

REPORT TO THE ROCKEFELLER FOUNDATION ON PROGRESS IN SOLVING PATTERSON SYNTHESES, by M. J. Buerger. June, 1954.

Report of experience in using the three-dimensional minimum function to solve the structure of terramycin hydrochloride.

Geophysical Analysis Group

CASE STUDY OF HENDERSON COUNTY, SEISMIC RECORD, PART I, by E. A. Robinson, S. M. Simpson, M. K. Smith and W. P. Walsh. Report Number 3, July, 1953.

Computed results of an experiment testing the use of prediction-type linear operators in evaluating seismograms.

LINEAR OPERATOR STUDY OF A TEXAS COMPANY SEISMIC PROFILE, PART I, by E. A. Robinson, S. M. Simpson and M. K. Smith. Report Number 4, July, 1953.

Computed results of an experiment testing the use of prediction-type linear operators in evaluating seismograms.

ON THE THEORY AND PRACTICE OF LINEAR OPERATORS IN SEISMIC ANALYSIS, by E. A. Robinson, S. M. Simpson, M. K. Smith, R. F. Clippinger, J. H. Levin and B. Dimsdale. Report Number 5, August, 1953.

Theoretical treatments of some properties of linear operators, and discussions of correlation, spectrum determinations, matrix inversion and the use of digital computers.

FURTHER RESEARCH ON LINEAR OPERATORS IN SEISMIC ANALYSIS, by E. A. Robinson, M. K. Smith, S. M. Simpson, H. W. Briscoe, J. F. Gilbert, R. Bowman, D. E. Bowker, S. Treitel, W. P. Walsh, M. S. Turyn and I. Calnan. Report Number 6, March, 1954.

Filter characteristics of linear operators, survey of data handling devices and results of various computational experiments.

Nuclear Geophysics Section

INVESTIGATIONS OF ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM AND ARGON IN CERTAIN MINERALS, by Patrick M. Hurley and Leonard F. Herzog. 1953 Annual Progress Report, Part I, March, 1954. A. E. C. Number NYO 3934-I.

VARIATIONS IN ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM AND ARGON AND RELATED TOPICS, by Leonard F. Herzog, William H. Pinson, Jr., Milo M. Backus, Lawrence Strickland and Patrick M. Hurley. Annual Progress Report, Part II, April, 1954. A. E. C. Number NYO 3934-II.

DEPARTMENT OF MECHANICAL ENGINEERING

Gas Turbine Laboratory

STALL PROPAGATION IN A CASCADE OF AIRFOILS, by Alan H. Stenning. Report Number 25, May, 1954.

A CASCADE TUNNEL FOR INVESTIGATION OF ROTATING STALL, by A. R. Kriebel and A. H. Stenning. Report Number 26, June, 1954.

AN AERODYNAMIC INVESTIGATION OF VANED DIFFUSERS FOR CENTRIFUGAL COMPRESSORS, by Charles R. Faulders. January, 1954.

DEPARTMENT OF METALLURGY

Ceramics Division

(Issued through the U. S. Atomic Energy Commission)

THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTOR MATERIALS: QUARTERLY PROGRESS REPORTS, by F. H. Norton and W. D. Kingery: July 1, 1953, Number NYO-3646; October 1, 1953, Number NYO-3648; January 1, 1954, Number NYO-6441; April 1, 1954, Number NYO-6442.

TOPICAL REPORTS, by F. H. Norton, W. D. Kingery, A. L. Loeb, J. Francl, R. L. Coble and T. Vasilos: September 30, 1953, Number NYO-3647; December 30, 1953, Number NYO-3649; June 30, 1954, Number NYO-6444.

STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES: QUARTERLY PROGRESS REPORTS by F. H. Norton and W. D. Kingery: July 1, 1953, Number NYO-6291; October 1, 1953, Number NYO-6290; January 1, 1954, Number NYO-6292; April 1, 1954, Number NYO-6294; July 1, 1954, Number NYO-6295.

TOPICAL REPORT, by F. H. Norton, W. D. Kingery, F. A. Halden and M. Berg, September 30, 1954, Number NYO-6289.

Metals Processing Laboratory

THE DUCTILE FRACTURE OF METALS: MECHANICAL ANISTROPY IN S.A.E. 4340 STEEL, by Davis S. Fields, Jr., Walter A. Backofen and John Wulff. Technical Report Number 4, September, 1953.

DEPARTMENT OF METEOROLOGY

CLOUD DROP, by D. P. Keily. Quarterly Progress Reports Numbers 13, 14, 15 and 16; Scientific Report Number 4, July, 1954.

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