CONCEPTUAL DESIGN

OF

THE ROYAL HELLENIC
RESEARCH INSTITUTE

ATHENS, GREECE

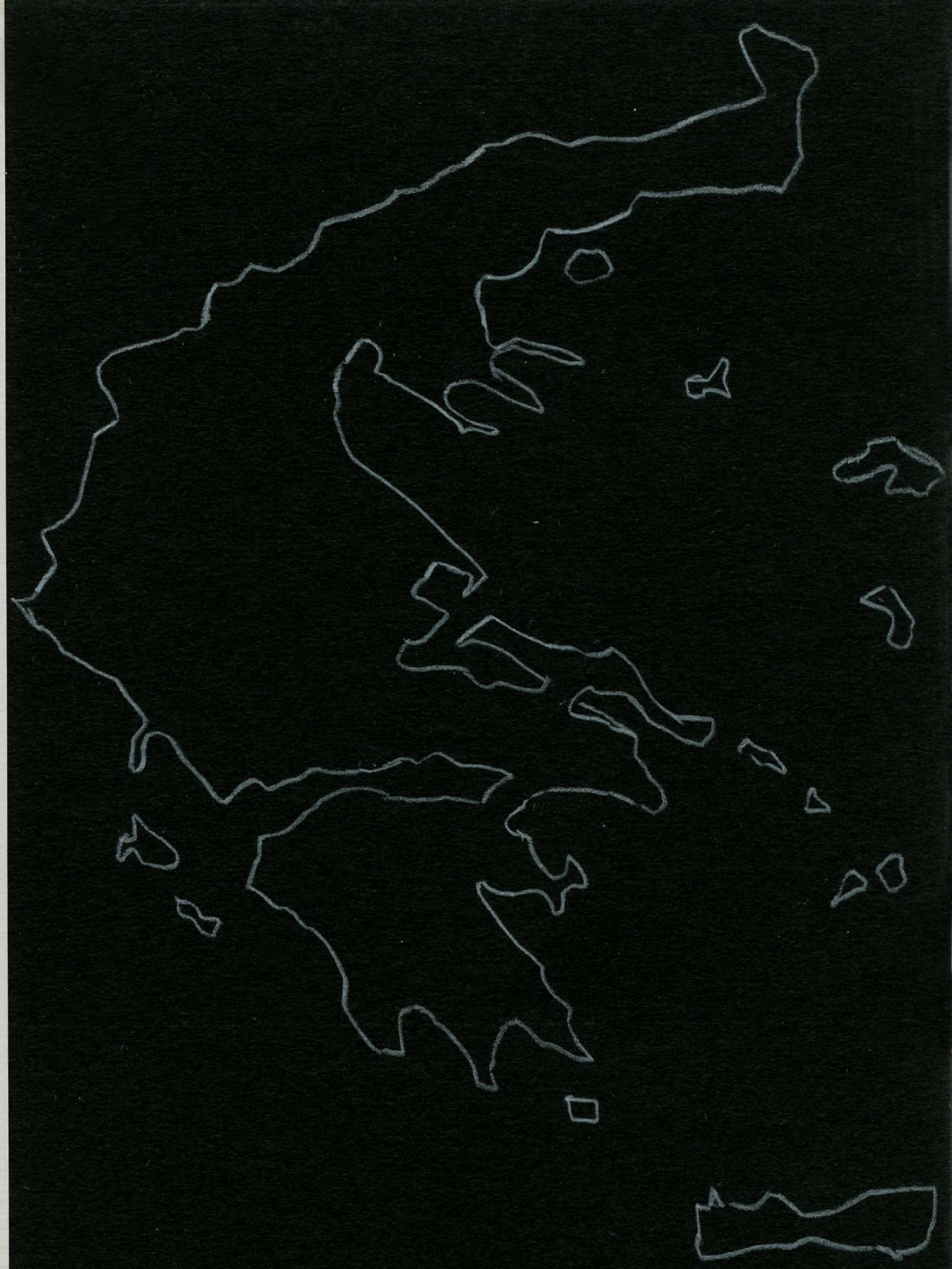
A REPORT

TO

THE ROYAL HELLENIC
RESEARCH FOUNDATION

C-63797

MARCH 9, 1962



Arthur D. Little, Inc.

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Mr. C. Th. Dimaras
The Royal Hellenic Research Foundation
4 Vassilissis Sofias
Athens, Greece

Dear Mr. Dimaras: 63797

We present the results of our work on behalf of your Foundation relative to the conceptual design of a library/laboratory structure to be built on a selected site in Athens.

We enjoyed working on this project and we hope that we shall have other opportunities to serve your organization.

If we can assist you or your architect in making the transition from concept to structural and aesthetic design, please let us know.

Very truly yours,

ARTHUR D. LITTLE, INC.

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DRAWINGS

I. THE GENESIS OF THE CONCEPTUAL DESIGN

This report summarizes work undertaken by Arthur D. Little, Inc. on behalf of The Royal Hellenic Research Foundation, the object being the conceptual design of a library/laboratory structure to be built in Athens. It is necessary to understand the reasons for the existence of the Foundation to understand the basis for the conceptual design we have worked out.

THE ORIGINS OF THE PROJECT

The Royal Hellenic Research Foundation was recently established and has as its primary objectives the encouragement and support of basic research in the natural sciences and moral sciences, the upgrading of higher education in Greece, and ultimately the putting of scientific research to work in the nation's economy.

At present, there are few opportunities in Greece for pursuit of careers in the sciences, and as a consequence, talented graduates of the nation's universities leave the country to find adequate opportunities to earn a living and build their professional careers. This bleeding off of some of the best trained intellects is a strong influence militating against the maintenance of strong faculties in science at the institutions of higher learning, and in fact, is an obstacle to the growth of the nation's scientific capabilities in competition with the world in which it lives.

Certain individuals have long understood the problems confronting Greece in this regard, and have been laboring for many years, and in a

variety of ways, to improve the situation. Recently, a number of these people have joined forces and have found practical ways to carry forward and implement their ideas for improving the situation. The most necessary element is a means for providing in Greece the financial support, the environment and the working tools, so to speak, that would attract able scientists, and make it possible for them to carry on work in their chosen scientific fields under favorable conditions.

The combined efforts of the people most interested in solving the implied problems have borne fruit in the establishment of the Royal Hellenic Research Foundation by royal decree, and in financial assistance supplied through the United States Operations Mission in Greece. In accordance with an established plan, approximately $4,500,000 was contributed from this source; two thirds of this fund is to comprise a basic "endowment", and the balance is for establishing the physical facilities needed to implement the Foundation's program.

THE PLAN FOR A LIBRARY/LABORATORY

Although the purposes of the project are intensely practical ones, the founders had the concept, in which we heartily concur, that care should be taken to make the physical embodiment of the Royal Hellenic Research Foundation a symbol of the nation's aspirations and an inspiration to all who will see it. Therefore, it was considered essential to place the library/laboratory on a site consonant with this view, hopefully in the newly developing Civic Center of Athens. Such a site has been provided by the Government of Greece, and in our judgment, provides an adequate plot of land for the purpose intended. The shape of the plot is somewhat irregular, and may present a challenge to the architect, but on the whole, it furnishes the kind of site required for the structure to be designed.

In our contacts with the members of the Board of Trustees and the professional staff of the Foundation, we have heard the proposed library/laboratory referred to as the "Institute"; we do not know whether this has official sanction. It seems to us that this term is a good and descriptive one, and that it has many parallels in other countries. Therefore, in this report we shall refer to the proposed library/laboratory as, "The Royal Hellenic Research Institute," representing the physical facility and its operating staff. Thus, where the "Institute" is referred to, we mean the building itself, and its working parts, as distinguished from the Foundation, which has broader interests. This term is used for convenience, and we have no intention of urging its official adoption if this has not, in fact, been done.

It has been impressed upon us many times that the library of the Institute will be a most important feature. It is to be a first-class periodicals library, with a substantial component of reference books. The emphasis on periodicals is justified by the fact that Greece does not now have such a periodicals library, while it has several good libraries of reference books, among which is the Gennadeion, located only a short walk away from the proposed site of the Institute. Although the periodicals library is intended as an essential element in an important basic research effort, as represented by the Institute and its work, it is intended, also, as a means for stimulating, encouraging and nurturing scientific, technological, and academic efforts elsewhere in Greece by making a fine, large periodicals library available to qualified persons for the first time.

In addition to the library, the Institute is to provide laboratory facilities, with all that implies, for basic research in the natural sciences (such pursuits as archeology, paleontology, etymology, and the like).

It is intended that the Institute shall act as a "seed-bed" for the development of Grecian science and letters, and not be an end in itself. In the world we live in, science and technology is playing such an important and growing role that any research institution is usually faced with the phenomena associated with rapid growth, one of which is the need for expansion of its physical plant at intervals. At the beginning, we had some reservations about the validity of locating the Institute on a small plot of land in the Civic Center of Athens, where it would probably be impossible to acquire contiguous land later, as opposed to a surburban site where a large plot of land could furnish practically unlimited opportunity for expansion in future years.

In the first place, the Institute is to be confined to fundamental research, which does not have quite the same connotations for rapid expansion as does applied research. Next, if some specific segment of the Institute's work should flourish beyond all expectations, and outgrow the then existing capacities of the physical facilities, it would probably be advisable to re-establish such an activity in a separate, specialized facility of its own, perhaps as a branch operation, on a new site. The circumstances would be such that the rapidly growing segment would, by that time, be large enough and strong enough to function as an entity, and perhaps even part of the periodicals library would accompany the research activity to a new location.

Thirdly, if the Institute's work should flourish to an unusual degree, another possible division that would follow logical and reasonable lines would be to separate the natural science activities from the moral science activities, removing one grouping or the other from the original Institute structure to another one, elsewhere. Perhaps the library would be divided

along the same lines at the same time.

Lastly, the proposed site for the Institute offers the opportunity for enough expansion to accommodate any credible amount of library content or fundamental research activity for so many years into the future, without any need for concern about anything except funds to be used for the purpose, that we see no valid reason to fear excessive restrictions on growth due either to the size or the location of the plot of ground in question. Indeed, as we have acquired understanding of the circumstances, the problems most likely to be encountered are the sufficiently rapid acquisition of periodicals and books, and the finding of enough qualified scientists and scholars to use the facilities being established. Consideration of all of the factors involved has led us to the conclusion that these are the real problems, and we have gotten over any doubts about the adequacy of the site for the intended basic purposes of The Royal Hellenic Research Foundation. The site is big enough to permit the establishment of facilities substantially exceeding what might be termed "the critical mass" for an important library/laboratory activity devoted to fundamental research, and this is all that need concern us at present.

In addition to the provisions for library and basic research facilities, the Institute will be the headquarters for the Foundation, itself. Because one of the Foundation's objectives is to stimulate interest in and appreciation of basic science and academic achievement, and to up-grade the nation's educational facilities, the Foundation will have many occasions to sponsor meetings of one kind or another, some of which will most conveniently and most effectively be held at its Institute. Thus, this kind of activity must be kept in mind in arriving at the conceptual design for the first unit of the Institute.

The Royal Hellenic Research Institute, then, located in the Civic Center of Athens, will be the headquarters of The Royal Hellenic Research Foundation, will offer for the first time in Greece, a first-rate periodicals library, available to all qualified persons and covering a wide range of scientific, technological and cultural interests, and will furnish first-class facilities for a professional Institute staff engaged in fundamental research in the natural sciences and moral sciences.

II. THE BASIS FOR THE CONCEPTUAL DESIGN

Special Note on Terminology

We found more than one system in use in Greece for designating the floors in a building. In this report, "Ground Floor" and "First Floor" are synonymous. The floor above the "First Floor" is designated the "Second Floor", and so on.

BASIC REQUIREMENTS

A substantial amount of work had been done on the design basis for the Institute before we were retained. As our own thinking developed, it became apparent that the early work was, in many respects, well done and represented a good evolution of ideas pertinent to the task at hand. It is especially true that the over-all result represented realistically what the creators of the Foundation concept generally want to accomplish. Our contributions have been to check carefully the requirements for physical facilities, reduce these to specific terms, acting the role of skeptic until we were convinced that we had arrived at a sound conclusion, and then create a conceptual design.

Perhaps it should be said at once that nobody knows for sure exactly what should be provided, for the Institute represents a kind of enterprise which has no precedent in Greece. Plans for its establishment must be made on the basis of the results its sponsors are determined to accomplish, and upon the assumption that the availability of Institute facilities and Foundation financial support will attract, and eventually generate, scientists to staff the Institute. The Institute is thus the "hen", and the "eggs" will come later.

Many interviews and discussions in Athens furnished the basis for determining the kinds and amounts of space that should comprise the Institute. The basic requirements for the first unit have been stated as follows:

1. A library, with all necessary auxiliaries, to accommodate about 250,000 volumes of periodicals, along with about 50,000 volumes of reference books. The library is to include a large, well appointed Reading Room capable of handling the numbers of readers likely to use such a library, and provide the services and the private or semi-private working space such readers need in a reference library.

2. Laboratories and auxiliary facilities for the natural sciences, capable of handling about one hundred workers. This figure was based on the assumption that ten senior scientists would need about ninety lesser scientists, along with necessary technicians and clerical assistants.

3. Facilities for ten to fifteen moral scientists and their assistants.

4. Headquarters offices for the Foundation.

5. Service facilities for the Institute, including heating and air conditioning, service shops, photographic dark room, restaurant facilities, document reproduction, and the like.

6. General facilities, such as conference rooms, a lecture room, and the like.

7. Parking facilities, in the quantity needed currently, with reservation for expansion of parking space as the use of private automobiles increases in future years.

8. The capability for expanding the structure to some extent, or adding other structures, without interfering excessively with established operations or destroying the functional or aesthetic integrity of the first unit.

The first unit is not to include any provision for accommodating basic research in biology. Such provision is to be made in future construction; or, if needed sooner, and before existing space is all in use, work in biology will be established in laboratory areas originally allotted to physical sciences.

SPACE REQUIREMENTS FOR VARIOUS PURPOSES

After a number of discussions in Athens, and study of the requirements for various functions, we arrived at a plan which can be summarized as follows:

GROSS SPACE ALLOCATIONS

	SQUARE METERS	
	FIRST UNIT	ULTIMATE
NATURAL SCIENCE AREA	2,223	3,333
MORAL SCIENCE AREA	694	1,157
LIBRARY	3,057	4,814
FOUNDATION HEADQUARTERS	741	741
CAFETERIA & KITCHEN	324	324
MECHANICAL EQUIPMENT	278	278
WORKSHOPS	370	370
RECEIVING & SHIPPING ROOM	93	93
STORAGE AREAS	463	463
UNASSIGNED SPACE	370	370
TOTAL AREA	8,613	11,943

These allocations were later adjusted somewhat as decisions were reached as to the placement of each within the building, and as necessary features were added, such as washrooms.

PLACEMENT OF FUNCTIONAL AREAS IN THE BUILDING

Many configurations were studied, based upon the space allocations for the various functions. Our experience indicated that, if possible, laboratory areas should be on the ground floor. This is all the more true if one has no knowledge of what kinds of work will actually be conducted in the laboratories. For reasons associated with floor loadings and vibration effects, natural science laboratories can usually benefit from a ground floor location more than is likely to be the case with the moral sciences, for example. Similarly, mechanical equipment used for heating, air conditioning, maintenance, apparatus construction and repair, and the like, can best be accommodated on the ground floor. In the case of some facilities, such as a steam plant, the head room required may exceed the normal distance between floors; this can be accommodated by lowering the foundation at that point only, --- an opportunity not available on any other floor.

Grouping the natural science laboratories and auxiliary facilities, the mechanical equipment and maintenance areas, and a receiving/shipping area on the ground floor required a total area roughly equal to requirements for the library and auxiliaries. A plan to have the library occupy the second floor evolved, and has survived many critical examinations of the functional arrangement. The other functions then fell naturally into the third floor, and in every case, this appeared to be the very best place for them. Thus, a three-story building comprises the basic concept which we believe will work out best on the specific site assigned to the Institute. A three-story building of the size contemplated ultimately would occupy a reasonable portion of the total available land area.

In order to make possible the reduction of our theoretical concept to some kind of specific conceptual design which can be subjected to quantitative

analysis, we had to choose some definite building arrangement as a means for recording and conveying the results of our work. At this point, the conceptual designer is confronted by a very difficult problem; he must be definite and specific without introducing limitations that would stifle the creativity of the aesthetic and structural designers who will follow him. We have been mindful of these relationships and have exerted our best efforts to accomplish our objectives without compromising those of the design architect. Nevertheless, patience and understanding will be needed in making the transfer from functional concept to aesthetic concept. It is our strong desire to give the design architect as much freedom as possible, so long as certain functional features are retained which we have carefully worked out, and which we shall clearly identify.

A SUGGESTION FOR A SPECIAL STRUCTURAL ARRANGEMENT

It has not been possible to do the work we have done on the functional design of the Institute without reference to some of the possible structural arrangements. One of these seems to us to merit serious consideration. It relates to the probability that many people will visit the Institute in order to use its library, and that by far most visitors who enter the building will do so for this purpose. For this reason, it might well be considered proper to put the library, or at least that portion most likely to be used by visitors to the Institute, on the ground floor. Since we believe there are compelling reasons for putting other functions on the ground floor, we speculated about the possibility of making the main (public) entrance to the building at the second floor level. The aesthetic design is quite likely to require architectural treatment of such a kind that rather imposing, broad steps, leading upward to the main entrance, would be appropriate. By establishing the first floor slightly below grade, keeping windows above

grade, the public entrance could be at the second floor elevation, close to the door to the Reading Room which we believe will be the destination of most visitors. We offer this concept without any intention that it should limit the aesthetic or structural designers. We merely wish to make a matter of record the fact that we gave functional consideration to the routing of visitors to the library Reading Room in relation to our choice of the ground floor location for laboratories, and a second floor location for the library. If later designers wish to have the principal (public) entrance at or near grade level, and there are many reasons favoring such an arrangement, proper recognition of the flow of visitor traffic can be given through arrangement of staircases leading to and from the second floor.

BASIC DIMENSIONS ARISING FROM MODULAR DESIGN

The space devoted to physical science laboratories on the ground floor is mainly subdivided into rooms each representing a configuration that we know works out well in practice. These laboratory rooms are distributed along both sides of a central axial corridor. The dimensions of these rooms from corridor to outside wall, along with the corridor width, define the width of this part of the building, if one end wall in each laboratory is to contain windows. The width so defined is over 18 meters, and thus is great enough to furnish a reasonable relationship between volume and area, and consequently, a reasonable construction cost basis.

As will be developed later, we attach considerable importance to the preservation of the basic laboratory room dimensions, at or close to our specifications. This fixes dimensions in the parts of the building where these laboratories occur, and affects the floors above these areas, as well. Fortunately, this imposes no onerous restrictions on the functional design

of upper floors; in fact, such dimensions seem to work out well where they have any significant influence at all. It is therefore the case that the detailed design of natural science laboratories has materially affected the size and shape of a large part of the building which is devoted to other functions, and to this extent the aesthetic and structural designers will be restrained within somewhat narrow dimensional limits. However, it is equally true that in a large part of the building, the configuration is not affected by natural science laboratory dimensions, and there is ample opportunity to relate the whole structure to its site and its environment.

VERSATILITY OF THE LABORATORY MODULE

As will later become apparent, the dimensions, fixtures and utility distribution systems characterizing the ground floor laboratory rooms are adaptable to a wide variety of uses, and these rooms can be combined into larger areas by omitting partitions. The laboratories can be used for chemical, physical or biological research, by varying the kind and amount of fixtures, and for many kinds of fundamental research projects in each of these fields. These same rooms can be adapted for use as office areas for scientists or clerical workers, and a standard room can even be subdivided readily to provide a suite for a scientist and his secretary.

In view of the versatility of our laboratory room plan, there is no need to be completely or irrevocably committed to any specific allocation of laboratory space for work in a specific scientific field. It seems likely that as time goes on, work in chemistry will tend to collect in one part of the laboratory area, and work in physics in another. Perhaps it would even be foresighted to position the early projects with this in mind, but the point we wish to make is that our recommended design does not impose any strong necessities to do so, and that merely by rearranging fixtures,

any laboratory can readily be converted from one purpose to another.

FACTORS INFLUENCING LABORATORY UTILIZATION

Earlier, it was pointed out that, at the moment, no one can determine precisely what research work will be conducted in any part of the Institute. The establishment of fundamental research may require physical facilities and financial support but it is utterly dependent upon finding qualified scientists who already have a strong desire to investigate a specific, worthy scientific subject. One cannot simply think up a subject for investigation and offer an opportunity to someone to look into the matter. Once a principal scientist begins work at the Institute, his personal interests and the course of his research will determine the subject matter of his investigations. He will attract other scientists to his banner, and thus science groups are likely to grow from nuclei established from time to time.

The fundamental research subjects that will be under investigation in the tenth year of Institute operation, for example, will be determined mainly by the principal scientists the Institute meanwhile has happened to attract, rather than by any specific scientific research plan created by the Foundation's Board of Trustees. At most, the Foundation's leaders can influence this course of events only by seeking and finding qualified scientists in accordance with some over-all notion of what research is most likely to achieve the Foundation's objectives. For example, a conscious decision can be made to place a certain amount of emphasis in the natural sciences on the field of chemistry, the field of physics, or the field of biology. This decision might result in a preponderance of one science, or in a rather well balanced distribution of the sciences, but it will not determine the subjects to be researched.

GROWTH RATE AND CHANGING NEEDS

It is our understanding that the time has not come yet when the Foundation's leaders can make decisions on such a matter; in fact, it would appear that it might not be an easy or a quick task to find and establish qualified top-flight scientists in The Royal Hellenic Research Institute. The Institute is to be a Greek enterprise, and a substantial part of its success will depend upon the interplay between staff members in many regimes. The ordinary means of communication will be, and should be, the Greek language. Even if the Foundation is able to offer the finest in facilities and financial support, it may take some time to put the science facilities into full use.

As regards the library, the rate at which periodicals and books accumulate will depend more upon the amount of funds available than upon any other factor. So far as the utility of the library is concerned, the sooner the library is developed to its fullest capacity, the better off will be the people who will be using it. The present plan is to start the library small and let it grow slowly to its full size over the course of about thirty years. This plan is based upon the amount of funds that it seems reasonable to allot for the purpose, in competition with the needs for other purposes. The rate of acquisition might be increased if more funds become available but current planning seems to indicate that, for some years to come, library activities will not demand nearly all of the space eventually to be occupied.

We have considered what might happen if, for example, the physical sciences and life sciences activities of the Institute should grow very fast, and fill up all of the allotted laboratory area long before the library would need the very large stack areas just above the laboratory

areas. Would the Foundation be willing to undertake the construction of a new wing to house more laboratories, when the existing structure had plenty of unoccupied floor space? Would it be wise for the Foundation to do such a thing? We believed that both questions could be answered in the negative, and that it would be desirable to prepare for such a contingency. This was accomplished by providing access to all utilities connections in the floor slab for the positions of the second floor which are above the first floor laboratories. If they should ever be needed, merely lifting floor covering will make it possible to install laboratory benches, and the like, without structural alterations to the building. Various other building details have been provided in accordance with this plan, and all of these matters are covered in detail in later, appropriate sections of this report.

The kind of space needed for fundamental research in the moral sciences is mainly office space, or space of a type closely resembling this. If moral science activities should exceed the space specifically allotted in the first unit, there are many places in the building where expanded needs can be accommodated, including a large area contiguous to the designated moral sciences area, into which the first such expansion would be most likely to occur. If the demand exceeded even this large area, additional spaces could be created on the second floor, in unused space eventually planned for library stacks.

It thus seems to us that we have achieved a very desirable amount of flexibility in our conceptual design, -- flexibility that will allow the Foundation's leaders to plan the course of the Institute without being constrained by physical limitations of the building. When the time comes for the construction of a second unit, there will be an additional opportunity

to take advantage of the versatility factor. If, by that time, second floor laboratories were in use, there would be a choice between leaving them there and providing stack space for the library in the new wing, or of moving the second floor laboratories to the new wing so as to regain the second floor space originally designated for stacks.

Since an architect had not been chosen, our conceptual design had to be accomplished unilaterally, and without any indication of the building shape the architect will favor in order to take best advantage of the site to be employed. We chose a U-shape for our conceptual design drawings but this does not mean that we favor this shape or believe it is well adapted to the proposed site. We might have made our conceptual drawings in the form of a straight building representing a rectangle about 19 meters wide by about 160 meters long. This would have served equally well to convey our functional concepts.

III. THE LIBRARY

ESTABLISHING THE LIBRARY

The basic function of the library is to make the contents of periodicals and books available to the people who use the library, most often from its own resources, but sometimes from other libraries. An important responsibility of the library staff is to conserve and protect the library's property, but another one is to make literature available readily and conveniently.

Since the Institute's library is to be mainly a periodicals library, current acquisitions will normally be journals which may have to be bound later. Cataloguing will be a minor activity once the system is set up and the principal acquisitions have been absorbed. The most important step in the first phase of establishing the library will be the selection of the current periodicals the library wishes to receive, and the determination of the number of copies of each one, if more than one copy is desirable or necessary. This is a non-recurring task; once done, the basis for receiving the current literature is laid, and any changes, representing either additions or deletions, will require attention only occasionally. Finding and purchasing back copies of periodicals, either bound or unbound, is another non-recurring task, as is the finding and purchasing of reference books.

The Foundation's directors have stated that the library is likely to grow at a rather slow rate. The contemplated budget for the first five years for acquisitions is about 15,000,000 Drachmas (about $500,000). If this plan is followed it is apparent that few employees will be needed for receiving, cataloguing, indexing, and using the library's contents. If this rate is maintained the library will grow into the space reserved

for it only very slowly, and the ultimate goal of 300,000 volumes will probably not be reached until near the end of the twentieth century. Another possible conclusion is that a busy activity of the library might be to obtain facsimile reproductions of one kind or another from other libraries.

ORIGINAL TEXTS VS. MICRO REPRODUCTIONS

As a prelude to the calculation of space for bookstacks, we interviewed librarians at some of the outstanding American scientific and technical libraries. On the basis of their experience, we concluded that for some time to come, original journals and books, rather than microfilm or microcards, must comprise the main body of a library. Microfilm and microcards represent a last resort if original journals and books cannot be obtained. There is no indication of any very advanced techniques on the horizon that would make obsolete, in principle, a library based on stacks of original texts.

We also studied the question of normal, stationary stacks versus mechanized stacks, and inspected one installation of moving stacks in Switzerland. In our judgment, there is no reason to consider moving stacks for the Institute's library; we could find no good reason to go into this further, and no real advantage to be gained from such mechanization.

LIBRARY OPERATIONS

The library's operations will involve the following principal activities, among others:

1. Keeping up with developments in the literature of the natural sciences and moral sciences, from the standpoint of the librarian.

2. Initiating action to procure periodicals and books required to keep the library's service at the optimum level.

3. Receiving items for the library.

4. Cataloguing and indexing new items.

5. Placing items in the proper places in the library's stacks.

6. Furnishing consultation and advice to users of the library, to the end that they can get a reasonable return from the time and effort they devote to the use of the library.

7. Maintaining an up-to-date, well organized index system for the benefit of people who use the library.

8. Supplying service which will put periodicals and books promptly into the hands of the people who request them.

9. Returning library items after use to correct places in stacks.

10. Supplying facsimile reproductions of several kinds to library users, and doing so timely and economically.

11. In certain cases, making literature searches on selected subjects.

12. Supplying reference services to people who call for such service.

13. Binding periodicals, usually at annual intervals, and keeping books in good repair.

14. Conserving and protecting the library's property and controlling the use of periodicals and books to this end.

The users of the library are likely to fall into three classifications:

a. Members of the Institute staff.

b. Visitors from outside the Institute staff.

c. People who request service by mail, by telex, or by telephone without visiting the Institute.

The last of the three can be virtually ignored in considering space allocation and arrangement.

One of the principal features of the library, or of any library, is a Reading Room, where a user can consult an index or a librarian, arrange to obtain certain library items, and settle down to studying them for his purposes. Members of the Institute's research staff will have occasion to use the Reading Room, but will probably also be able to study periodicals and books at other points in the building, depending on circumstances. Visitors from outside, on the other hand, ordinarily will use library items only in the Reading Room and auxiliary spaces. In actuality, the consultation of the library's periodicals and books, principally in the Reading Room, is the reason for having the library at all, and all other items in the list presented earlier are necessary only to make this possible.

CONTROL OF PERIODICALS AND REFERENCE BOOKS

Since the library is a reference library, not a circulating library, it is assumed that no books or periodicals will normally be allowed to be taken out of the library areas by anyone except qualified professional employees of the Institute, and then only after proper records have been made. The rationalization of such a regulation is that the library contents must be kept available at all times for ready reference, since there is no way to anticipate the instantaneous needs of the workers who depend upon the reference library. Rules should not be completely rigid; for example, the library might have duplicate copies of certain items, and hence be in a position to take the risk of lending one copy for important purposes.

Since one of the primary functions of the library is to serve the needs of the research staff of the Institute, it would seem to be reasonable to allow responsible research staff members to take any

but a few of the library's rarer volumes to their own quarters in the building, provided there is a real need to do so, provided proper records are made to keep track of the library's property, and provided the recipient assumes responsibility for the items taken out. In our judgment, the policies and procedures recommended by a competent professional librarian could safely be followed.

One should differentiate between current periodicals that are to be vital working elements in almost daily use by the Institute staff members, and current periodicals that are to be kept available for consultation in the library Reading Room. Each basic research group will be interested in certain specific journals which it will need to have at its fingertips. Subscriptions for such copies should be separate from those for reference copies to be kept in the library. The number of non-library subscriptions will depend upon the number of people needing ready access to the journals in question. No doubt, in the case of a periodical of interest to only a very few people, the library might not need a separate subscription, but could catalog and index a staff member's copy as soon as it could be spared for the purpose. This might be a month or two after its original receipt.

It is of great importance that subscriptions be placed through the library staff, so the Librarian will be aware of the availability of all journals, and know to whom to go to locate specific copies if a demand arises.

FACSIMILE REPRODUCTION FACILITIES

In order to minimize the need for removal of volumes from library areas and maximize the service to be performed, first-class facilities should be established for making facsimile copies of documents, as required.

This will be an important convenience for Institute staff members, but also for library users from outside. Several kinds of copying machines may be needed; for example, it would be useful to have a Xerox machine or equivalent, for quick, cheap copying of text, but Xerox does not copy half tone illustrations well, and so a Photostat machine would be useful for some purposes. For other applications, microfilm might be indicated, as well as enlarged prints from microfilm.

For a variety of reasons it is advisable to have the space for facsimile reproduction open off the main Reading Room. People using the Reading Room who identify material they want copied should be able to carry the material to a service window where they can complete the necessary arrangements. Provided satisfactory financial arrangements can be made, much of this kind of demand can be satisfied promptly, while the customer waits. Some, however, would have to be handled on the basis of later delivery. Since there will be times when several people may line up awaiting service, and may be carrying heavy books, it would be advisable to have a long counter, perhaps of the order of 4 meters in length, where transactions involving facsimile reproduction can be completed. In order not to disturb people at nearby reading tables, it would be well to screen off this area from the Reading Room.

It is our belief that one well equipped facility will suffice to serve both outsiders and Institute staff members, at least in the early period of operation. Later, some facsimile reproduction facilities might well be needed in non-library areas, and separate installations might be justified. Since a Haloid-Xerox machine now available will turn out as many as 200 copies per hour, if worked to capacity, it will probably be a long time before the extra machines will be needed, or could be justified.

Arthur D. Little, Inc.

One matter to be kept in mind in connection with facsimile copying is that machines such as the Xerox machine cannot copy well from most permanently bound volumes, because the page to be copied cannot be entirely flattened against the copy paper. Consequently, a portion of the text nearest the bound edge does not appear at all on the copy, and some of the text that does appear is likely to be distorted. This difficulty can be avoided if unbound duplicate copies of journals are kept. Even with other facsimile copying methods, such as Photostat, or equivalent, the copying operation is facilitated if the unbound journal is available.

It will be necessary to determine prices for facsimile copies with care; the problem will be to avoid excessive financial loss and still keep prices low enough to encourage a large volume of work. This will require some experimenting.

THE LIBRARY STAFF

A minimum staff for the library might be as follows:

1 Librarian

1 Assistant Librarian

1 Secretary to the librarians

1 Professional cataloguer

2 Typists for cataloguing and indexing

2 Stack attendants

1 Operator for facsimile reproduction

1 Receiving and handling clerk

This staff should be able to operate the library satisfactorily in its early phases. More or less work will develop depending upon the library's rate of growth. The exact size of the staff cannot be predicted

firmly, but the variations would not seriously affect space needed.

The space requirements for this staff includes offices for the Librarian and Assistant Librarian, with a small adjacent office for their secretary; these offices should be well located with respect to the work rooms and the Reading Room. The Librarian should occupy an office somewhat larger than the average office as a matter of prestige; an Assistant Librarian would usually be at the main desk in the Reading Room, and would thus be adjacent to the principal work areas. Perhaps two Assistant Librarians will ultimately be needed, one oriented to the literature of the humanities, and one toward the natural sciences. Such a sub-division may be desirable, and the library office complex can accommodate this eventuality.

The professional cataloguer should have an office or partitioned private work area in, or immediately adjacent to, the cataloguing work area. The cataloguers and typists should each have about 9 square meters. This is an optimum figure for conventional libraries, but is probably a minimum for the library in question in view of the cyclical schedule for most of the items received, particularly in view of the cataloguing delays that may be imposed by translation requirements.

As the activities of the Foundation grow, a need may arise for a professional Technical Editor to handle articles to be published by the Institute staff members. Some part of the library area could therefore include an office space allowance to provide for this expansion of the library's service on the assumption that the function can best be conducted as part of the library organization. Space for an Editor and a secretary-typist would be a desirable inclusion.

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THE READING ROOM

The library Reading Room should be capable of accommodating three basic types of readers:

1. The transient visitor who wishes merely to check quickly a file reference or a catalogue.

2. The reader who is interested in the current journals and who seeks a quiet atmosphere for a limited period.

3. The reference worker who is going to be occupied for considerable periods and generally requires at least semi-privacy.

Our study of experience elsewhere in Athens led us to the conclusion that the Reading Room should be planned to accommodate approximately 100 readers concurrently. The Foundation's directors asked for storage space in the Reading Room for about 10,000 reference books -- the most frequently used -- and perhaps about 1,000 titles of current periodicals. The stacks to hold 10,000 books will occupy a total area of about 75 square meters. The stack area necessary for the open display of periodicals can vary substantially depending upon the type of stack used. If the open vertical type is employed in which the latest issue stands vertically, and prior, recent issues are stored flat in a small shelf underneath, then a stack corresponding to the storage of about 125 volumes of books will accommodate 15 titles of periodicals. Allowing equivalent access and corridor space, the open storage of 10,000 current periodicals in the Reading Room would require a total space allocation of about 92 square meters.

The total space allocation in the Reading Room for the storage of 1,000 current periodicals and 10,000 volumes of books would thus be about 167 square meters. This should be regarded as a minimum value

because it assumes that the displays of current periodicals will have only the same access space as do conventional bookstacks. A reading room layout should be somewhat more open than a stack area, and this is further justified by the probable turnover of readers. Whereas the planned occupancy is 100, experience of existing reading rooms in Athens where periodicals are available indicates that a turnover of 600 to 800 readers per day is a possibility.

Another desirable feature in the stack area would be the provision of a vault or other limited-access area for the storage of rare documents of high value. Such a vault might be of particular interest to the Moral Sciences Staff and feasibly might be a part of that staff's facilities, provided that cards for the contents of the vault were included in the general catalogue of the library.

A special provision should be made in the stacks for the storage of maps and other large or odd-sized documents. (The Library of the American School of Classical Art in Athens encountered this problem.)

An ultimate stack allowance of about 2750 square meters will be required to house 250,000 volumes of periodicals and 50,000 reference books. All of this space will not be needed immediately. Stack allocations should be based upon average values of 140 volumes of reference books or 100 volumes of periodicals per square meter of floor space, assuming the use of conventional stack units, and 0.92 meter aisle and corridor spacing. If the total stack space is subdivided into a number of areas, and if the library service includes only limited access to the stacks, each controlled stack area may need a stack attendant. A control desk can be located near the entrance to

the stack area. Needless to say, there should be only one door in normal use for entering or leaving each stack area, although emergency exits should be provided, perhaps controlled by alarm bells. Remote observation via television might be useful.

Occupancy of 100 persons for the Reading Room involves a space commitment of about 280 square meters. A slight reduction in this figure can be effected if there is an overlap between access space to the periodical and bookstacks and the access space to the Reading Room tables, and if rectangular tables are used. In any event, an average figure of not less than 2.5 square meters per reader should be used. If round tables are used here and there for the sake of aesthetics, the average space per user will have to be increased slightly.

Optimum distances are about 1.07 meters between a wall and a table and 1.5 meters between tables. Tables about 2.36 meters by 1.6 meters (72" x 34") will serve four readers. Smaller ones are more acceptable to readers; it is a recognized fact that library users prefer to sit alone at a table whenever possible. Carrels, or cubicles, for individual readers may be provided in addition to, or in place of, individual reading rooms.

The main card catalogue and bibliographic tools of the library should be included in the Reading Room, along with provision for a Service Desk, with accompanying storage space; the storage space must be large enough to accommodate books returned from circulation ready to be returned to stacks. These three service items together will occupy about 92 square meters.

It will be advisable to have facilities available for reading microfilm and microcards. In our judgment, one reader of each type should be installed, at the beginning, as a part of the Reading Room facilities. If the situation develops so professional members of the Institute staff have to depend upon microfilm and microcards to a great extent, other readers may be justified for their use, entirely apart from the public Reading Room.

The main Reading Room, including the index, catalogue, and circulation facilities, can be expected to require a total area of at least 540 square meters, and possibly a little more if an attempt is made to give it a roomy atmosphere and take advantage of aesthetic opportunities to avoid tiresome uniformity.

STACKS

Stacks should be about 0.92 meter apart for easy access. Stacks placed perpendicularly to the walls, at least 0.92 meter from the wall, instead of along the walls and in the middle spaces, offer the maximum in efficiency, and can subdivide the room into semi-private areas desirable for the readers of journals.

Current trends in library design often emphasize "mobility" in the storage of library items. Stack equipment is generally appraised on the basis of its ease of assembly, disassembly, and adjustment. However, experienced librarians admit that the stack facilities gradually assume the status of fixed emplacements. Careful planning of stack areas is essential; reliance upon convertibility and mobility is not an adequate substitute. It will become increasingly difficult to alter the stack arrangement as the library stock grows, and the tendency will be to expand the outer boundaries of existing areas.

The stack areas outside the Reading Room will ultimately contain about 97% of the library's holdings. As the stack occupancy increases, the need for rapid, accurate access to the stacks will also increase.

Institute staff members should have free access to the stacks. To avoid the complexities of a system under which members would have to take items from the stack area through checkouts, or the like before using them, reading tables should be provided at intervals in the stack areas.

LIBRARY WORK AREAS

Acquisitions of periodicals and books, new and old, will require a certain amount of clerical attention for the preparation of requisitions and orders, for general correspondence, and for approval of invoices. Generally, the procedure for acquisitions will be initiated by the librarians, and most of the paper work will probably be handled by their secretary, at least during the early period of the library's existence.

Receiving of new acquisitions and other material destined for the library will occur via the general receiving and shipping room on the first floor, but will be unpacked in a work space in the library area on the second floor. Presumably, the best position for these activities will be next to the freight elevator.

Shipping of library items to outside points, representing sale or trade of surplus items, periodicals to be bound, and the like, will be handled in the same way, and in the same area as receiving.

Cataloguing and indexing of new acquisitions will be done close to the place where acquisitions are received and unpacked. A proper

storage rack will be needed where new items can repose safely until the cataloguers are ready for them. Storage space for this purpose should be generous, for periodicals are likely to arrive in batches, some of which may be of substantial size. Cataloguing and indexing will take time, and will require some holding space of its own; the necessity of translating information from foreign languages into the Greek language will slow the process somewhat.

Binding might well be handled through outside contracts during the early part of the library's existence if satisfactory service can be obtained nearby, but it would not be advisable to depend upon an outside arrangement unless contract binding could be done quite promptly. It would be undesirable to have the library's periodicals and books unavailable for long periods.

It appears probable that the library will have to have its own bindery in the not very distant future. A lot depends upon the form in which periodicals are acquired; perhaps a large proportion of back issues will be purchased already bound. Even if only current issues are considered, and if the library is receiving about one thousand different periodicals as issued, the binding job is big enough to justify setting up the facilities for handling it inside. The volume of work would be great enough so the cost would be reasonable, and the security and convenience of doing the binding on the premises would be a compelling influence.

The need for binding is at its peak just after the end of the calendar year. When duplicate sets of a given journal are available, much can be done to make ready long before the end of the year. In

cases where a single year's issues comprise several volumes, as in the case of the "Chemical Abstracts", of the American Chemical Society, only the last volume in the annual set has to be delayed until the last issue and the annual index are in hand. Nevertheless, there is quite likely to be a greater need for binding of periodicals during the first half of the year than during the second half. Since the library will have to do a certain amount of maintenance binding, to offset wear and tear due to handling, good use can be made of the bindery the year around by concentrating maintenance binding in the second half of the year.

We estimate that binding of current periodicals, alone, will probably amount to at least 1,500 volumes per year, and when the bulk of the library is in use, maintenance binding will account for at least another 1,000 volumes, for a total of at least 2,500 volumes, or about 50 volumes per week. A bindery for such a work load would probably employ about two people, perhaps with an occasional assist from others.

The bindery has no special need to be near any other library facility. It can be located in any convenient part of the building where such an operation would be appropriate. The amount of space required will depend upon the choice of operating procedures. The actual binding takes very little space, and the over-all requirement will depend mainly upon the amount of space required for storing periodicals and books waiting to be bound, and materials and supplies employed in the binding operation.

FEATURES THAT MUST BE PROVIDED

There are a few features that must characterize an efficient reference library. We believe these to be as follows:

1. The librarians should be located close to the main work areas of the library, and should also be readily accessible to visitors who have good reason for wanting to see them. In this sense, "visitors" would include members of the Institute or Foundation staffs, as well as people from outside.

2. The Reading Room should be so located that it can be found easily by people entering the building for the purpose of using it.

3. Visitors entering the Reading Room should immediately encounter the Service Desk and the main card index.

4. Since the people performing the cataloguing and indexing functions are constantly working with the main card index, the cataloguing and indexing activities should be located nearby. This immediately fixes the space relationship between one specific point in the Reading Room and onepart of the necessary library work area.

5. Users of the Reading Room need to have ready access to the place where facsimile reproductions can be made. Therefore, the space to be devoted to machines for this purpose should be just off some part of the Reading Room. There are reasons for associating the facsimile reproduction activity with other library work areas. For example, supplies needed at frequent intervals should pass through the hands of the receiving clerk after arrival on the freight elevator; it would be convenient to have all these in the same general area.

At times, clerical workers nearby, such as cataloguing typists, might be able to assist readers needing facsimile service, if the facsimile specialists happened to be overly busy, or perhaps absent momentarily.

The suggested location principle then indicates that the facsimile reproduction facility should be in the part of the library workroom area nearest to the Reading Room. Earlier, it was suggested that conversation related to service might disturb occupants of reading tables nearby unless some kind of sound screening were provided.

6. Current periodicals and bound periodicals used very frequently should be readily accessible to visitors without involvement of attendants.

7. A certain body of the most frequently used reference books, perhaps about 10,000 volumes, should be readily accessible to visitors without needing the service of attendants.

8. Reading Room work tables should be provided for use by most of the visitors from outside, with provision for a certain amount of private space for readers who require and deserve such facilities.

Readers favor individual tables, as opposed to sharing larger tables with others, even though no more table area per person is supplied. Many modern libraries use tables such that two people face each other, with a low barrier, perhaps 10 cm. high, dividing the two halves.

Private alcoves, or carrels, or small, individual reading rooms can be provided in a number of ways, depending upon the design of the Reading Room. We believe that it would be adequate to provide

private space for about twelve readers, opening off the main Reading Room. It is essential to arrange this space so it can be controlled from the Service Desk; that is, so people using the private reading spaces cannot take periodicals and books out of the Reading Room without being seen by the attendants. In general, it can be assumed that private space will not be used by people using current periodicals, but rather by people making extensive use of back issues and bound volumes. Most of these will probably reach the user via the Service Desk; hence, it might be well to locate these spaces near the Service Desk if it is otherwise convenient to do so.

9. Except for the periodicals and reference works purposely placed within easy reach of visitors in the Reading Room, all other periodicals and books should be kept in stacks in areas barred to all save authorized personnel. Closed stack areas therefore require barriers to access by people other than library employees.

Qualified members of the Institute's professional staff should be permitted into closed stack areas, being admitted as necessary. For their convenience, reading tables should be placed here and there in the stack area. A good plan would be to provide one reading table space for each 7,500 volumes in the area.

DESIGN PLAN FOR THE LIBRARY

Of all the various parts of the Institute, the library is the one based on the most definite and specific criteria, for the Foundation leaders have stipulated firmly that, in its full development, the library is to house 300,000 volumes, about 50,000 of which will

be reference works, and the balance bound periodicals. Furthermore, a Reading Room equipped to handle eighty visitors at one time was specified; after some study, this figure was increased to one hundred people. Along with these facilities is to go the associated facilities for the professional and working staff of the library.

Our drawing CL-429, dated March 1, 1962, shows a functional layout with the library occupying the entire second floor of the Institute's first unit. The headquarters of the library, which is to say the offices of the librarians and their clerical staff, is located just off the second floor lobby, near the stairs and elevators. The Reading Room opens off the same lobby, and the main door into the Reading Room is prominently located with respect to the stairs and elevators. If a building plan were to be chosen which made the second floor lobby the main entry, the entrance to the Reading Room would be the most prominent feature a visitor would note upon coming into the Institute.

The principal work area of the library is centrally located, across a corridor from the librarian's offices, and communicating with the Reading Room. This latter serves a number of useful purposes, but two have been mentioned with special emphasis; the cataloguing and indexing people need to be able to get at the main card index in the Reading Room, and patrons need to be able to pass easily from the Reading Room to the area where facsimile reproductions are made.

A number of private reading alcoves are provided in the Reading Room. Two huge stack areas are provided, in addition to the Reading

Room, totaling 1450 square meters. A large storage area is designated, but in fact this space is not different in any respect from the stack space, and is interchangeable with it. Two rooms are provided for lavatories and toilets for men, and two for women; in addition, there is a women's lounge. There are two janitor's closets.

The Foundation management would naturally like to establish the library in its fully developed form from the very beginning, since this would offer the maximum service to potential users of the library. There are many reasons for believing that this cannot be done, some due to financial requirements and others due to the practical difficulties of assembling a library staff and finding, acquiring and absorbing such a huge amount of literature.

The Foundation management has taken the position that the library will grow very slowly, acquiring current periodical literature and the most popular reference texts first, and building back from that. Under such a plan, only a small corner of the second floor of the Institute would be needed to take care of the entire library operation during the first five years; for with such a small library, not much space would be needed for the library employees and the behind-the-scenes work, for stacks or for reading tables. With a small library, the main patronage would probably be from the Institute professional staff, which in that event is itself not likely to be very large; it will not be easy to attract outstanding scientists unless a large library is available.

In pondering these relationships, we came to the conclusion that it would be wrong to think in terms other than providing space for a major library in the first unit of the Institute, regardless of the

rate at which literature will be acquired, or the rate at which library space will be occupied. In view of the circumstances surrounding the establishment of the first building unit, we believe it is sounder to provide the space and see it only sparsely occupied during the first few years than to adopt a building design that would make the first unit fully occupied very quickly but insignificant as a structure and ill adapted to future expansion. If the Institute is to be a vigorous force in Hellenic science and the nation's development plan, it must not be forced into a paltry mold. We preferred to assume that, somehow, the Foundation will obtain the funds and the skills to bring the library into being at a much faster pace than is indicated by the first assumption; indeed, we feel that this is essential if the research activities are to prosper.

ROLE OF THE LIBRARIANS IN FINAL DESIGN

Some of the details of library arrangement really should be decided by the professional librarians who are to be responsible for the successful operation of a first rate library. Since an Institute librarian may not be chosen for some time yet, or if chosen, may not be ready to commit himself as regards certain design details, it will be very helpful, indeed, if the design architects can defer final arrangements, to whatever degree is practical without risking too much, until the Librarian is available and prepared to state his preferences.

We believe that a considerable amount of such deferment will be feasible, since the library is largely just open space. For example, it seems reasonable to believe that the exact design and location

of a Service Desk in the Reading Room need not be determined immediately. The precise design of reading tables for various purposes might well be deferred for quite a long time.

ADAPTABILITY OF LIBRARY SPACE TO CHANGING CONDITIONS

Our study of many kinds of libraries, and the activities that characterize large and well laid out libraries, made it evident that partitions are of little significance in good library design. Bookstacks fulfill many of the functions of partitions. They can be arranged to suit a library's current requirements, and can be rearranged to fit a library's changing requirements. Book stacks can be kept on very wide spacing when excess space is available and can be pushed together into minimum spacing when the library reaches its ultimate capacity. Very wide spacing between stacks that face each other is of little consequence in the efficient use of the library, since the user works along the face of a stack, and not back and forth between facing stacks.

Although we were alert for opportunities to provide for future library needs in the over-all layout, we came to the conclusion that only a few partitions would be needed in the library area, even when the library floor is completely occupied by library activities. Bookstacks can occupy virtually any space not needed for something else. On the other hand, space reserved for stacks can be used for almost any kind of library need, if there is some unexpected need for extra assistance. Therefore, we believe that by, providing specific areas for librarian's offices, for work areas for receiving and shipping, cataloguing and indexing, for binding, for facsimile

reproduction, for a Reading Room, for large,closed stacks, and for storage of library furniture and the like, the principal, continuing requirements of a busy library can be met. If an extraordinary effort were to be undertaken, -- as for example, if funds became available to build the library up in five years instead of thirty, and if most of the back issues of periodicals required binding -- the larger than normal complement of cataloguers, indexers, typists, bindery workers, and the like, could be put to work on the library premises with no difficulty. Plenty of good space would be available in areas designated for stacks or storage.

The fact is that open, well ventilated, well lighted space is the dominant character of nearly all of the space requirements for the library. Although we tried very hard to determine whether there were notable exceptions to this generalization, we were unable to find any of substantial significance.

IV. NATURAL SCIENCE LABORATORIES

GENERAL FEATURES OF THE LABORATORY AREA

The area devoted to physical science laboratories and auxiliary services is structurally one of the most important in the building, since elaborate utility distribution systems and special fittings are involved.

In designing any laboratory grouping it is desirable to analyze the various uses to which individual laboratories are to be put, and then design the smallest number of different kinds of laboratory facilities that will provide the range needed. It is important to avoid, as much as possible, highly specialized designs that will fit only one kind of research activity, for laboratory projects are often short lived, or in a state of flux; highly specialized laboratories might soon be obsolete, and reclaiming the space for other purposes might involve radical structural alterations to the building.

The implied problems are greatly complicated, in one sense, when there is little or no information available as to the nature of the work to be carried on in the laboratory areas. In another sense, the problem is simplified, for with few clues to guide one, the only sound procedure is to design laboratories that are, more or less, general purpose and easily convertible from one purpose to another. This is the course we have pursued. We have a certain basis, laid down by the Foundation management, which indicates that, in the first period of the Institute's existence, the laboratories will be used for fundamental research only in chemistry and physics; biology will probably not be represented until much later. We were also told to design for about ten top-flight research scientists, who will have associated with them about ninety lesser scientists, technicians and clerical workers.

Our drawing CL-428, dated March 1, 1962 shows the general features of the physical sciences area which occupies a large part of the first floor. Most of the space is planned according to a laboratory module about 6.1 meters by 7.9 meters. There are twenty rooms of this size, along with a substantial number of rooms of other sizes and shapes that can be used for laboratory, office, storage or conference room purposes. One such area, at a central point, is designated as an analytical instrument laboratory.

A large area is allocated for workshop activities, including apparatus construction and repairs, glass blowing, instrument maintenance, glassware washing, and general building maintenance requirements. A portion of a large stockroom will be occupied by laboratory supplies, and this will be the point where such materials are withdrawn by laboratory workers.

Aside from the use of our specific modular design for most of this space, the other areas can vary with the configuration chosen by the design architects in adapting the building to the site, the arrangement chosen for stairs, and other such matters. So long as the twenty modular units are provided, and the balance of the space is roughly equivalent to that shown on drawing CL-428, we are satisfied that the plan will work.

GENERAL SPECIFICATIONS OF THE LABORATORY AREA

The general specifications for laboratory areas are given below. Dimensions are in metric or international units, with American equivalents in parentheses in those cases where the articles are available only in these dimensions; for example, the thickness of floor tile is given as 0.32 cm (1/8 inch). The references to specific materials of construction and fabricated items by brand names and names of American suppliers are given for purposes of illustration. In all but one instance, quite satisfactory alternate materials are available which are either well known to architects

or are readily identified by reference to standard sources.

The general specifications for laboratory areas are as follows:

General Specifications for Laboratory Areas

1.00 Laboratory Rooms

1.10 Room Size - All laboratories shall be approximately 6 meters wide by 8 meters deep.

1.20 Ceiling Heights - All laboratory rooms shall have ceiling heights above floor of approximately 3.3 meters.

1.30 Acoustics - The ceilings of all laboratory rooms shall be finished with fireproof acoustic tile. The 1.9 cm thick (3/4 inch) tile as manufactured by the Owens Corning Fiberglas Company, or equal, is recommended.

1.40 Floor Covering - All laboratory floors shall be finished with either asphalt or vinyl asbestos tile .32 cm thick (1/8 inch).

1.50 Lighting - It is recommended that all laboratories be lighted by means of suspended fluorescent fixtures spaced to provide light at an intensity level at bench top of 60 to 75 foot candles.

1.60 Wall Finishes - All laboratory walls shall be finished in keeping with local custom and tradition. No special wall treatment is ordinarily necessary for normal laboratory activities.

1.70 Services - The following services shall be supplied to all laboratory rooms: - air, gas, steam, electricity, hot water, and cold water; in addition, adequate drain lines under the floor, connecting to a sewer.

1.80 Safety Requirements -

1.81 Alternate Exits - Each laboratory shall be equipped with two properly placed means of egress. This is best accomplished by installation of swinging doors in the partition near the exterior wall, as indicated on our drawing DL-431, dated March 1, 1962.

1.82 Safety Shower - Each laboratory shall be equipped with an emergency shower nozzle, situated near a corridor door. This installation may be connected directly to the cold water distribution system. No floor drain is required, since actual use of the shower stream is rare, and even then is of short duration.

1.83 Fire Extinguishers - Every laboratory shall be equipped with one or more fire extinguishers of a type most nearly suited to the kind of operations generally to be carried on there.

1.90 Ventilation - In general, no special ventilation is required in the laboratory rooms other than that provided by the normal air circulating or air conditioning system. Work with toxic, or fume producing materials should be conducted in exhaust hoods, details of which are discussed more fully in Section 2.40 of these specifications.

2.00 Laboratory Equipment

2.10 Work Benches

2.11 Bench Height - Standard laboratory benches shall be approximately 1.0 meter in height. Lower benches or tables may be used where appropriate.

2.12 Bench Width - Standard laboratory benches shall have the following widths: - wall bench 0.76 meter; center bench 1.37 meters.

2.13 Bench Spacing - In laboratories equipped with two wall benches and one center bench, as depicted on our drawing DL-431, the spacing between benches shall be approximately 1.5 meters.

2.14 Spacing of Services - Each laboratory bench shall be supplied with services as indicated on our drawing DL-431, with an outlet for each service at approximately 1.3 meter intervals.

2.15 Bench Cabinet Materials - Cabinets for laboratory benches shall be constructed of steel, and finished with a baked enamel coating similar to those manufactured by the Laboratory Furniture Company.

2.16 Bench Top Materials - The bench top working surface shall be 2.54 cm thick (1 inch) Colorlith as manufactured by the Johns-Mansville Co., or approved equal. This material is available in an assortment of colors.

2.17 Reagent Shelf - Both wall and center benches shall be equipped with a reagent shelf as indicated on our drawing DL-431. In the case of the center bench, the reagent shelf may be mounted on top of pipe support racks; and over the wall benches by means of standard shelf brackets. The reagent shelf shall be 1.27 cm thick (1/2 inch) Colorlith of the same color as the bench top working surface.

2.20 Sinks - Each laboratory shall be equipped with at least one general purpose sink, mounted flush with the bench top working surface.

2.21 Materials of Construction - Laboratory sinks shall be made of natural soapstone as provided by the Laboratory Furniture Company, or approved equal.

2.22 Size - All laboratory sinks shall be approximately 0.45 meter by 0.6 meter by 0.2 meter deep. (18 by 24 by 8 inches)

2.23 Locations - One sink shall be located at the end of a center bench as indicated on our drawing DL-431. Additional sinks may be located on wall benches as necessary.

2.30 Condenser Bowls

2.31 Condenser Bowls - Shall be constructed of chemical lead.

2.32 Size - Condenser bowls shall be approximately 7.5 X 23 cm in size.

2.33 Location - Condenser bowls shall be located on all center and wall benches at approximately 1.3 meter intervals at the back edge of the bench top. A water outlet fitted with an aspirator connection shall be mounted above each bowl.

2.40 Hoods

2.41 Type of Hood - If the laboratories are to be air conditioned, induction type hoods shall be used. In non-air conditioned areas by-pass hoods shall be used.

2.42 Size - Fume exhaust hoods shall be approximately 1.65 meters in width, 0.75 meter in depth and 2.5 meters high.

2.43 Materials of Construction - Hoods shall be of welded steel framework with cement asbestos board panelling and shall be equipped with a 0.65 cm (1/4 inch) safety glass sash capable of being raised and lowered, as supplied by Laboratory Furniture Company, or equivalent.

2.44 Location - Hoods shall normally be mounted on wall benches. Walk-in type hoods may be used when this is appropriate. One to three hoods shall be located in each laboratory depending upon operating requirements.

2.45 Exhaust Rate - An exhaust system shall be provided which will assure an exhaust velocity of at least 30 meters per minute at the face of the hood, with the hood wide open.

2.46 Exhaust Fans - The housing of the exhaust fans shall be of either fabricated steel or cast iron construction; the fan shall be equipped with a blade made of non-sparking material and shall be designed for low speed operation to reduce noise and prolong life of the unit. The fan shall be sized to give an exhaust rate in keeping with paragraph 2.45 above.

2.47 Type of Exhaust System - Each hood shall be equipped with a separate exhaust system.

2.50 Provisions for Special Equipment

2.51 Some or all of the laboratory benches may be omitted in some laboratories to provide space for the setting up of special equipment or testing of newly developed apparatus. An example on our drawing DL-431 shows a case where the center bench is omitted. (Typical Laboratory No. 2)

2.52 Service Connections - In the event center benches are initially omitted it is recommended that service branch lines be provided as usual but blanked off so as to be able to connect them up later.

2.60 Provision for Desk or Writing Surface Space - Desk or writing surface space may be provided in several ways. Two methods are indicated on our typical laboratory layout on drawing DL-431.

3.00 Specialized Areas

3.10 Space in the laboratory area shall be set aside and properly equipped for specialized applications. Typical of the specialized facilities that should be considered are:

3.11 A constant temperature room (about 22 C) and a constant humidity room (50% relative humidity); may be combined.

3.12 Photographic studio and dark room.

3.13 X-ray, infra-red and other analytical instrumentation.

3.14 Electronic computers.

Until more operating information is available it is recommended that one laboratory module or equivalent be set aside for each of the above categories.

3.20 Storage Facilities

3.21 Storage for chemical and laboratory apparatus and supplies shall be provided as indicated on our drawing CL-428.

3.22 Storage facilities shall be provided as indicated on our drawing CL-428 for the storage of idle equipment and samples.

3.30 Solvent Storage - A properly vented solvent storage room shall be provided in conjunction with the chemical stockroom area. To provide positive exhaust of both heavier-and lighter-than-air fumes, ducts at both ceiling and floor levels must be provided.

LABORATORY FIXTURES VS. LABORATORY FUNCTIONS

Elsewhere, it has been mentioned that our modular design for standard laboratory rooms can be adapted to a wide variety of uses for fundamental research activities in the natural sciences; that is to say, the module is well adapted to the needs of chemists, physicists or biologists and their helpers. The basic principle involved is the spacing of the principal fixtures. This is of special importance in chemistry laboratories where experience has taught us that a spacing of about 1.5 meters between parallel benches is optimum. This is based upon the stature and stride of adults, and represents the best compromise between the minimum practical working space between parallel benches if only one person is involved, the space needed when two persons are working back-to-back at parallel benches, and the requirements for movement of persons who must use the space between benches as an aisle to get from one place to another. The 1.5 meter spacing is also adequate in case certain special apparatus is used in front of a bench which cannot well be put on the bench.

The bench spacing of approximately 1.5 meters can be employed in small laboratories, based on only two parallel benches or in a laboratory about twice this size, where there are benches at right angles to the corridor, ---two against the walls, and one double bench in the center. The latter arrangement is illustrated by Typical Laboratory No. 1 on our drawing DL-431, and is a common type of arrangement in innumerable laboratories. The same

spacing applies in very large laboratory areas where there is row upon row of parallel double benches. Such arrangements are very effective for much of the work that goes on in laboratories devoted primarily to chemical research, using benches with a height of one meter; but, for other kinds of work lower benches, desk height tables, no benches at all, or special facilities, such as trellises, (simetimes called "condenser tables", or "distillation racks") are appropriate.

Physicists need open spaces where special equipment can be floor mounted. Their work is often hampered by the presence of benches in the center of a laboratory room, such as the one represented by our module, but for many kinds of fundamental research in physics the Typical Laboratory No. 2, shown on our drawing DL-431, is very useful. Wall benches give good, versatile facilities for many kinds of work, and the omission of the center bench gives a large free area which can be occupied by equipment standing on the floor, or by portable tables of any desired height. The utilities outlets normally intended to be connected to a center bench can be tapped to serve whatever is needed for apparatus assemblies in the middle of the room.

Some kinds of natural science research can best be done on a so-called "trellis". A trellis is erected by installing a low table, the top only about 20 to 50 cm above the floor, from which metal rods one cm or so in diameter, rise vertically to a point near the ceiling. The rods can be in a straight line, 20 cm or more apart, depending upon the kinds of work to be done. Various kinds of laboratory apparatus can be mounted on the rods by means of standard laboratory clamps and horizontal rods clamped to the vertical rods. Because the vertical rods can be numerous, and are quite long, it is easy to arrange a large number of different kinds of apparatus

items in desirable spatial relationships, to form a very complex system. The trellis is much more versatile in this respect, and it is much easier to design, construct and work with complex systems, than is the case with standard benches and so-called "ring stands". This is true for almost any kind of natural science research which requires the use of complex systems. Suppliers of laboratory furniture offer devices under various names that give the advantages of the trellis, but they are simple to make to suit local conditions.

In the case of biological research, there is often the need for desk height tables on which microscopes, for example, can be supported. When this is the case, portable tables of the correct height and design can be substituted for normal benches. Usually, electrical outlets, into which lamps and illuminators can be plugged, is the only utilities service required.

FUME HOODS

Virtually every chemical or biological research worker has some use for a fume hood, if he observes the rules of safety. Whether he does, in fact, use a fume hood when he ought to use one depends to some extent upon the reasonable availability of hood space, and the design of the hoods; that is, whether he can get access to a hood easily and work in it effectively and conveniently.

The valid attitude to take in planning a research laboratory is to try to make it as easy as possible for research people to gain access to well designed hoods when they need them, and thus promote safety as much as possible. In general, there are two ways to accommodate these needs. One is to provide hoods in every laboratory room where one or more probably will be needed; the other is to establish "hood rooms", where virtually the entire

working space is provided in the form of hoods. In some large laboratories, both kinds of hood facilities are provided.

The standard hoods supplied by reputable manufacturers of laboratory furniture are usually quite acceptable if purchased to proper specifications. Our specifications given under paragraph 2.40, of the General Specifications above, provide a reliable guide to the provision of workable hoods. Standard hoods are of two types, namely, bench hoods and walk-in hoods. The usefulness of walk-in hoods is greatly augmented if a trellis is provided inside the hood for mounting apparatus.

Providing hoods of either the bench or walk-in type presents little or no difficulty in the original design, or in altering an established laboratory, so far as the hood enclosure, itself, is concerned. However, the detail of conducting away the air flow that removes fumes from the enclosure is one which always presents difficult architectural problems, especially in a structure erected in a well settled area which must be protected against defilement of its aesthic faces. The Institute is in precisely this position. One cannot just blow the fumes out of the nearest outside wall. The reasonable solution along conventional lines is to conduct the fume-laden air from hoods through duct-work to the roof of the building and discharge it into the atmosphere as high up as possible.

In our judgment, fumes from normal fundamental research work in the natural sciences should present no problem if expelled to the air as high as possible in a three-story building in the Civic Center of Athens. The volume of fume is too small to give concern. The real design problem is to incorporate the ducting and provide fan installations at a reasonable cost. The solution of one part of the problem lies in the detailed structural design of the building. Presumably, the building will have to include one

or more lines of columns in its interior for support of upper floor and roof structures. Customarily, ducting is run up parallel with support columns, giving the appearance of a pilaster. By this means, the ducts are carried through the upper floors with substantially no more interference than would be encountered with the columns alone. Partitions on upper floors should be kept in line with ground floor partitions if at all possible.

Our experience has indicated that much better results are achieved if each hood is equipped with its own separate exhaust fan which can be turned on and off at will, without affecting any other hoods. When two or more hoods are on the same exhaust system, tension sometimes develops between a worker whose use of a hood interferes with some other worker's use of his hood. If each hood is to have its own exhaust system, this must be taken into consideration in the structural design in such a way that hoods can still be added, as needed, after the original construction job has been completed, and the laboratories are in use. Not only that, but one should be able to add a hood without having to run ductwork outside of partitions or column spaces, thus confusing the interior design. This can be done by designing channels rising vertically to the top of the building, which are big enough to accommodate added ducts.

Competent structural designers can always find ways to solve the fume hood duct problem in the structural sense. What gives trouble is that ducting is fundamentally expensive; for one thing, it has to be corrosion-resistant. Ducting takes up quite a large volume in the building, and therefore is also a substantial cost item from this standpoint. The combined effect on costs is so great that there is usually a strong temptation to reduce either the number of ducts to be provided, or the

size of the ducts, or both. We cannot urge too strongly that this temptation be resisted. A research laboratory without a first class, safe means for disposing of fumes will have such severe limitations that the work will suffer greatly, and perhaps even critically. Any part of a laboratory area where chemical or biological research is to be done should be well supplied with efficient hoods, or have the basic potential ability to be so equipped. In any situation in which arbitrary restrictions are imposed on the amount of fume hood facilities to be supplied, it would be far better to install really efficient hood service to a small area than to spread poor hood service over the entire area.

We recommend that, in the original unit, one hood be placed in each general purpose laboratory that is expected to house chemical or biological research work. Omit the hood from laboratories to be devoted to physics research unless there is some advance information that a hood is needed, and from constant temperature and constant humidity laboratories. Of the hoods installed, it might be well to make every third or fourth one a walk-in hood, instead of a bench-top hood. We recommend that provision be made in the structural design to accommodate at least two hoods in each laboratory, if the second one should later become necessary. We suggest that, in the case of one laboratory room module, in each wing, structural arrangements be such that ducting for about six hoods could be accommodated, if necessary; this would make it possible to create a sort of hood center for work needing rather intensive and extensive use of hoods. This might be an improvement on the later installation of extra hoods in individual laboratories.

Finally, we should point out the fact that, if natural science laboratories were to be built on the second floor, there would have to be

some reasonable way to install ductwork for hoods to serve the second floor laboratories.

SECOND FLOOR LABORATORIES

In Section II, above, we mentioned the possibility that the natural science research component might outgrow its space while there was still so much unused space in the building that the Foundation might be unwilling to build a new wing on the building. Since such a possibility is by no means farfetched, we pondered this problem and arrived at a rather simple and inexpensive method for providing for this contingency, --- a method by which laboratories could later be built on the second floor without having to undertake any significant amount of structural alteration to the building.

The method of distribution of laboratory services for the first floor laboratories.is well illustrated by our drawing DL-431, in the isometric view of a typical laboratory with its accompanying Detail A. The main headers are hung under the ceiling, and the feeder lines for laboratory benches drop vertically. The main headers run parallel to the corridors and at right angles with the benches. As shown in Detail B, instead of using tee-fittings in the main header, from which feeder lines could drop vertically, we propose to use crosses for this purpose, and plug the upper threaded opening of each cross with a capped short nipple. Directly above each cross, we propose to cast a cylindrical channel in the concrete pad comprising the second floor, each channel being of a proper size to accommodate its respective feeder line. If and when a laboratory is needed on the second floor, the services can readily be supplied merely by removing the capped nipples, removing floor tiles directly above the channels, and installing a vertical pipe of the desired

length which will pass upward through the ceiling insulation and the channel in the concrete floor, and so be fastened to a standard bench connection.

In addition to these overhead service lines and the method of passing them upward to the second floor, Detail B illustrates another very essential item, namely, a drain line to service the second floor. This will require a seventh vertical channel at the right point in the concrete pad through which the drain pipe from a second floor bench can pass to connect into a drain header. The header can lie parallel to the service lines, and be supported in the same manner as these lines. Arrangements should be made in the original building design for vertical drain lines to connect the horizontal header to the sewer, in the same manner as the drain header under the first floor. If the vertical connectors are not installed as a part of the initial construction, provision should be made so they can be installed and connected to the sewer later when, as and if needed, without having to undertake substantial structural alterations of the building (tearing out walls, digging up floors).

By using the suggested scheme, illustrated by Detail B in drawing DL-431, and slightly oversizing the supply lines at very little added cost, the Institute will be protected against unexpected developments to a very major extent. With these provisions, second floor space originally planned for closed stacks could be used for that purpose, for natural science research, for moral science research, for offices, for storage or for meeting rooms. In our judgment, this ability to accommodate the building to such a wide range of evolutionary developments is very desirable in a situation containing so many unforeseeable factors. We believe the Board of Trustees would be very prudent to make these simple arrangements,

which will cost very little if included in the original design, and which would save so much if laboratories were needed on the second floor.

SPECIALIZED AREAS

In paragraph 3.10 of the General Specifications, above, certain specialized areas are enumerated, representing spaces in the laboratory area that should be set aside and properly equipped.

A constant temperature room is likely to be needed in a fundamental research laboratory, as is a constant humidity room. We wish to caution against an error that is frequently made in designing such rooms if intended for a single purpose. The error to which we refer can be illustrated by an example which recently came to our attention. A room intended as a constant humidity room was surrounded by, not only a moisture barrier, but also by several inches of heat insulation. This superfluous use of expensive cork cost an extra $8,000 without contributing any benefit.

For most cases, the design of a constant temperature room is a fairly simple matter, unless there is some unusual heat load to handle. In normal cases, to maintain a constant temperature of, for example, 22 C the floors walls and ceiling do not need any special insulating materials.

For a constant humidity room, an effective moisture barrier completely surrounding the room is required. We have found that a good asphalt impregnated paper is adequate for a room to be maintained at 50% relative humidity.

In the case of either kind of constant condition, we have found it advisable to establish a plenum chamber by dropping the insulating tile ceiling below the concrete pad above, and feed the circulating conditioned air back into the room through perforations in the drop ceiling. The point to doing this is to secure uniformity of conditions throughout the

room. This is achieved without turbulence since the conditioned air falls as a "blanket" over the entire area of the room, instead of having a blast of air from some small, local source.

In some cases, it is practical to combine the functions of a constant temperature room and a constant humidity room in a single space, particularly for such purposes as bringing samples to equilibrium before testing.

Effective instruments and circulating systems adequate for ordinary needs are freely available from conventional sources.

A photographic studio and dark room are usually needed where fundamental research is in progress. For one thing, photomicrographs are frequently used in basic research projects for record purposes. Photographs of samples and apparatus assemblies are often used to illustrate reports on scientific experiments and to illustrate scientific papers. The preparation of photographic slides for use in lectures and paper presentation is common. When a laboratory is large enough, there is good use for a professional photographer. In our judgment, one is not likely to be required in the Institute for some years, and a studio and dark room will probably be for general use by whatever staff members have use for it. Under the circumstances, we believe a minimum design will suffice. An odd corner, windowless, with floor area of about 10 square meters that can be supplied with good ventilation, electricity, water and drains should be all that is needed for some time to come. We believe this facility might well be put in the area designated for workshops. When the time comes that the Institute needs a larger, better studio and dark room, it can take over one of the laboratory modules.

An analytical instrument room will undoubtedly be needed, although it would be impossible to guess when this necessity would become urgent. In

the early stages of a research laboratory's history, there is a considerable tendency for the people who need and can justify an expensive, complicated instrument such as an infrared spectrophotometer, an X-ray diffraction microscope or an electron microscope to set it up in their own laboratory. Consideration should be given, from the beginning, to the advisability of establishing a special area where such devices are to be installed, with the long range objectives in view. Since these complex, costly instruments eventually should serve all who need them, there can be great advantage in planning ahead to install them permanently and properly in a good place, and planning as well for competent operators under good supervision so effective service can be rendered to the Institute staff as a whole. By this means, dissension can be avoided, better over-all results can be obtained, and funds available for research support can be made to go further.

One or more electronic computers may one day be needed in the fundamental research work of the Institute, not only for extremely complex computations bearing on the development of scientific theories, but also for planning research experiments by manipulating mathematical models. A computer does not require any unusual preparation of the site, with the possible exception of providing for removal of the heat load.

OFFICE SPACE IN THE NATURAL SCIENCE AREA

On our drawing CL-428 we have labeled certain rooms on the first floor as being "office" or"conference room" spaces. These designations are not sacred; such spaces can be devoted to any reasonable purposes, --- even to creating laboratory spaces of a non-standard type. There would be no difficulty in extending service lines into these areas, if needed. Our partition lines in these cases, and our designations are intended to be illustrative.

It should be mentioned, also, that a line of offices across the corridor from the Shipping and Receiving Room are in a part of the building that can be varied to suit the architectural designer's needs, and there may be no such spaces in the final plan. However, there will almost certainly be a substantial amount of space over and above the group of standard laboratory modular units that can be adapted to office and conference room use.

The standard laboratory module is much too big to be used as a single occupancy office, but its dimensions are such that it can be divided well into office spaces. For example, a partition on the midline at right angles to the outside wall will yield two spaces wide enough for single offices of respectable size. Carrying such a partition a reasonable distance toward the corridor, and butting it against another partition, mostly glass, across the module, say at about 4.0 meters from the outside wall, would yield two offices about 3 meters by 4.0 meters and the balance of the space between the glass partition and the corridor would be good space for clerical assistants or junior scientists. A detail of such an arrangement is shown in the upper right hand corner of our drawing CL-428.

We are confident that adequate private and semi-private office spaces can be provided for those who need them, and that writing space can be made available to others, within the limits of the first floor plan that will develop.

ACCOMMODATING LABORATORIES TO SCIENTISTS

In an earlier section of this report, we expressed confidence that our laboratory module is adaptable to a wide range of uses for research in the natural sciences. We outlined some of the arrangements of fixtures that can be varied to meet the respective needs for chemists, physicists, and biologists. In addition to the characteristics that distinguish these

regimes, there will be personal preferences of individual principal scientists which it is wise to accommodate, if this can be done within the limitations of the basic plan.

Our drawing DL-431 shows details for Typical Laboratories No. 1 and No. 2. In No. 1, the space along the outside wall is occupied by shelves, while in No. 2 it is occupied by a long writing table. In No. 1, instead of one long writing table, there are two short ones. Some scientists will advocate writing tables near the door.

Certain scientists will want shelves in certain places, to store soiled or clean laboratory glassware. Some will want peg-boards for draining wet glassware. Almost any reasonable arrangement can be made, including variations in hoods as to type and number, presence or absence of benches, use of portable tables, trellises and the like, within the basic laboratory plan. We are aware that scientists do have these preferences, and that it is unwise to ignore this fact. Hence we believe that it would be a sound plan to defer the furnishing of laboratories as long as possible in order that a principal scientist can have an opportunity to express his preferences. We are not suggesting that the first phase end with the natural science laboratories being merely bare rooms, but rather that some of the rooms be only partly furnished with fixtures; for example, have only the wall benches already installed, and wait to see what will be needed in the center of the room.

V. MORAL SCIENCES AREA

The indications are that research work in the moral sciences will require mainly the kinds of space typical of good offices and access to a good library, along with a certain amount of general work space and storage space for materials associated with the moral sciences research. Increasingly, many kinds of mechanical, electronic, and optical devices will become important for moral sciences research. Among these will be such facilities as sound recording and sound reproduction, and cameras and projectors, as well as facilities for reading microfilm and microcards which will make available to Institute research scientists some of the contents of far distant libraries and museums.

We have provided for the first moral sciences area on the third floor of the Institute. A row of offices is just across the corridor from a large area set aside for general work space for moral scientists. We have chosen a module for this row of offices which gives each individual about 15 square meters of private office space. If this is considered inadequate for some cases, the partition lines can be changed so as to use 1 1/2 modules per office, but we believe that 15 square meters will be found to be a good size for one person who will not have to entertain more than three or four visitors at one time, and who will not be likely to need anything more than some bookshelves and storage cabinets, and a modest amount of file space for doing the work that takes place in his office. At the end of the wing are four non-standard office spaces; the larger ones might be appropriate for men of high prestige.

We have provided a group workroom of very substantial size where moral scientists can do the things that are inappropriate to a study. This room will have to be outfitted with tools, appliances, storage cabinets, work-

tables and work benches in accordance with the types of activity that develop.

Areas have been set aside for storage of photographs and film files . This room should be carefully air conditioned to the optimum temperature and humidity for safe preservation of these substances.

A studio is provided for sound recording and reproduction. This should be designed to have good acoustical properties, but we are not aware of any need for extraordinary acoustical treatment.

A storage room for recordings is provided which should be air conditioned to supply safe conditions for preservation of these materials.

Because the Institute is not a very large building, the people in the moral sciences area do not have far to go to get to any part of the library. They can get to the storeroom on the ground floor readily, and are close to the administrative headquarters of the Foundation.

A substantial area of unassigned space in the moral sciences area would furnish the natural basis for the first expansion of the facility. It could be converted readily into a row of offices that would be a mirror image of the one already shown, and would be just across another corridor from the work areas.

No spaces have been marked especially for clerical activities. These can be placed according to need. One module would handle two typists and voluminous files.

We believe the facilities provided on the third floor can house admirably the moral sciences activities likely to be initiated in the early years of the Institute's experience. The spaces provided will accommodate a wide range of activities such as might occur in the area, and are big enough and flexible enough to be adaptable to kinds of activity that cannot now be

foreseen but might be characteristic of moral sciences research. The building offers many other areas, on other floors, that could be used for unusual and unconventional needs of the moral scientists, and, in truth, the entire diversified facilities of the natural sciences laboratories, and the library, and their staffs can be drawn upon.

VI. THE FOUNDATION HEADQUARTERS

We have reserved a generous amount of space on the third floor for the main headquarters of the Foundation, and we have assumed that the general management of the building and facilities will be handled by the Foundation's paid staff. We have not attempted a detailed layout of the Headquarters offices, since this does not involve technicalities such as characterize the science areas, and is better left to a skilled architect who is familiar with local customs and attitudes. We have merely satisfied ourselves that there is ample room, over-all.

There will be a need for three kinds of space in the general administrative area. Facilities will be required for the general clerical task of operating the Institute and the Foundation (files, correspondence, procurement, hiring).

A group of offices will be needed for the Directors. There must be a Board of Trustees meeting room, with a suite adjoining for the Chairman of the Board. Whether additional office space should be provided for the other trustees, we cannot decide. All of these facilities for the Board of Trustees of the Foundation should be of a quality consonant with the eminence and the dignity of the people who will be using them, and should symbolize the significance and aspirations of the Foundation. This part of the building comprises a small fraction of the total and we believe the cost of doing the job properly will be well worthwhile and will not be a burdensome factor in the over-all cost of the Institute.

The third type of space in the general administrative area is that devoted to facilities to be used by all parts of the Institute.

This is best exemplified by an area devoted to the duplication of documents, using such systems as Ditto, Mimeograph, Multilith or equivalent. These facilities will be used for preparation of office forms, circular letters, memorandums when many copies are needed, reports, literature reviews, scientific papers and the like. A substantial amount of the results of the Institute's activities will reach the world outside through the medium of documents, and many of these will require the duplication of typescript. In our judgment, this is not a good point in the facilities to "economize". The duplicating center should be well equipped, and well staffed, and well stocked.

In the area to be devoted to the active day-by-day administrative work, it will be advisable to install a safe or vault for the safekeeping of vital records and irreplaceable materials. It seems to us that a waiting room for visitors near the elevator should be provided which need not be large, but should be well appointed.

VII. GENERAL FACILITIES

We have not attempted to incorporate in our plan all of the detail that the architectural designer will have to develop. Rather, we have dealt only with certain prominent features which have been under discussion with officials of the Foundation.

ELEVATORS

We are not certain that a three story building such as the Institute needs passenger elevators, or if so, that two passenger elevators would be required. In actuality, a good freight elevator will handle all of the utilitarian needs, and can also be used by workers who are partially disabled or who have heart conditions proscribing avoidable effort such as climbing stairs. A good freight elevator could handle also an emergency situation, such as one in which an individual collapses, and must be handled carefully on a stretcher or in a wheelchair. If one or more passenger elevators are installed, they ought to be adjusted to the proper speed for a low building.

A good freight elevator is a necessity. If some kind of passenger handling device must be installed, it may be much better to use one set of escalators, or even one escalator to take passengers up, only. These are matters that we believe can best be settled in Athens.

The freight elevator is placed to service the building's main shipping and receiving platform, the natural sciences area, the mechanical equipment and workshop areas, the library work area, and the kitchen.

CAFETERIA AND KITCHEN

Space has been set aside on the third floor for restaurant facilities to serve the employees of the Institute and visitors. The table space

is calculated to accommodate about 150 people at a sitting. We believe it would be well worthwhile to plan the kitchen so evening meals can be served, -- perhaps of a somewhat higher character than the mid-day service.

Our experience indicates no complications in having this facility on the top floor.

WASHROOMS

We have indicated spaces on each floor for washrooms for both men and women, placed about as they would occur in similar buildings with which we are familiar. This is a case where local custom and tradition may indicate a different kind of arrangement. We have made no attempt to arrive at decisions about private washrooms opening off private offices.

A ladies lounge on the second floor, in conjunction with a washroom, provides a place where a lady may retire if indisposed, and provides a type of space usually desired or required.

LECTURE ROOM

We have indicated space for a lecture room that will comfortably seat about 100 people, leaving reasonable room for a lecturer to function. A portable platform can be used if it is desirable to raise the speaker's level somewhat, say 25 to 40 cm.

This lecture room can be useful for a wide variety of purposes in addition to its primary purpose. For example, it can be used as a dining room for a smaller group than the cafeteria dining room will handle, as for example, for an evening dinner or small banquet. Folding doors might be used to make two smaller meeting or dining rooms. The location next to the kitchen is, of course, intended to make the service of food and beverages in the lecture room area feasible.

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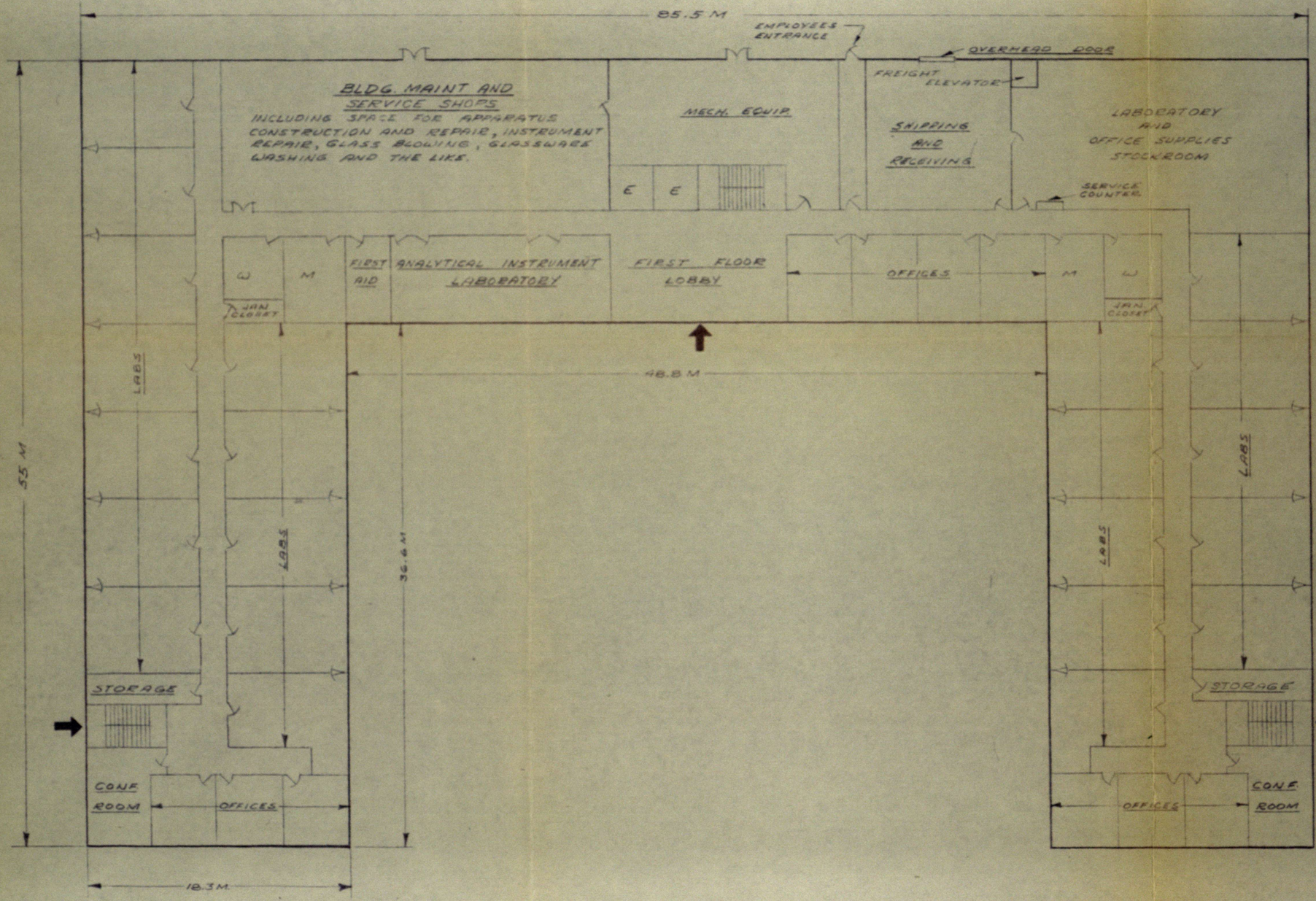
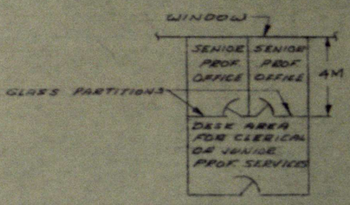




DETAIL SHOWING USE OF A LABORATORY MODULE FOR OFFICE PURPOSES.

FIRST FLOOR

SCALE 1:240

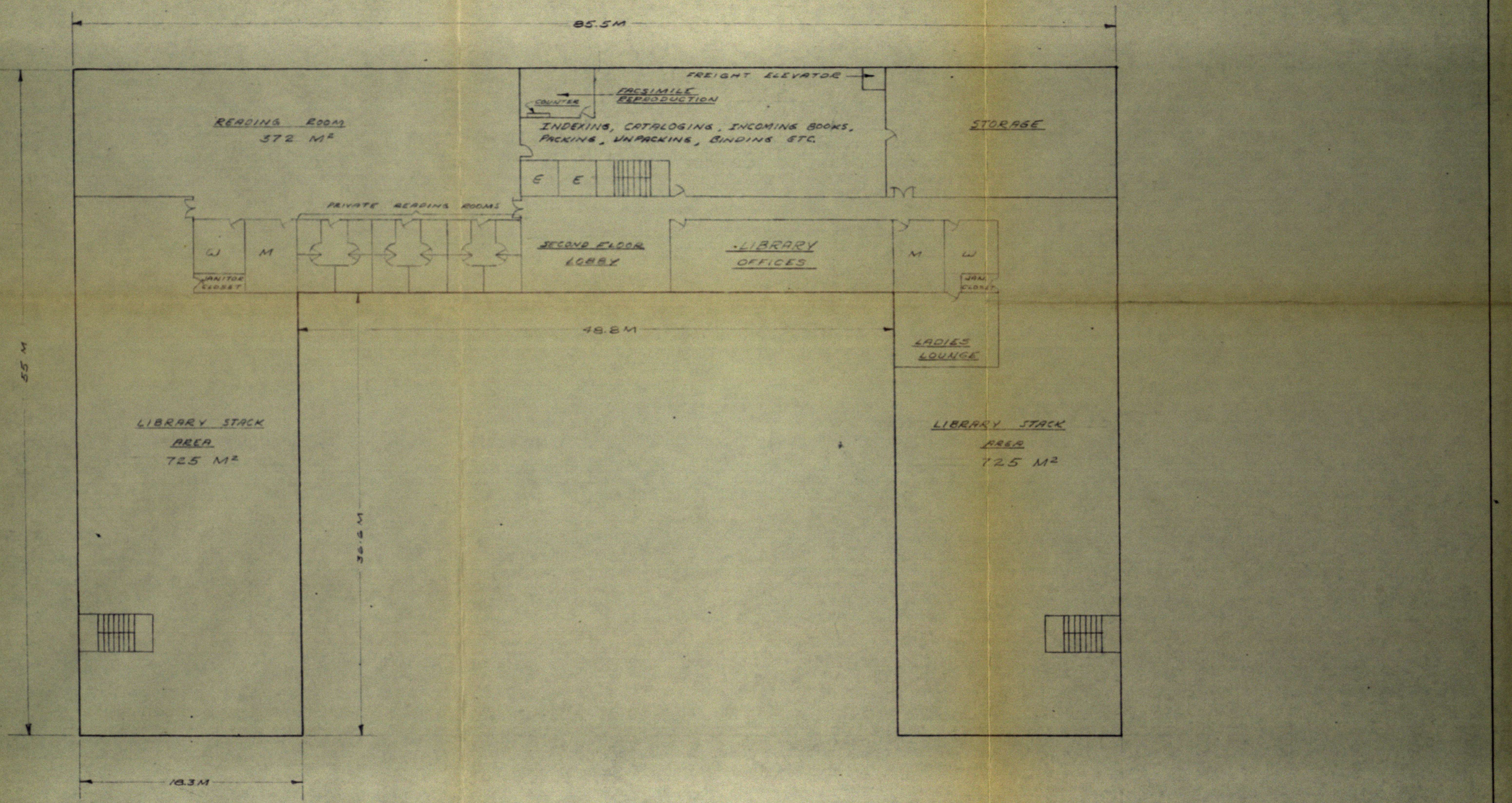
REV	DESCRIPTION	DATE	BY

Arthur D. Little, Inc.
CAMBRIDGE, MASSACHUSETTS

CLIENT: ROYAL HELLENIC RESEARCH FOUNDATION	CASE NO. 63797

FIRST FLOOR

DWN J L N	CHKD	
DATE 1 MARCH 1962	APPD	
SCALE 1:240	APPD	CL-428



SECOND FLOOR

SCALE 1:240

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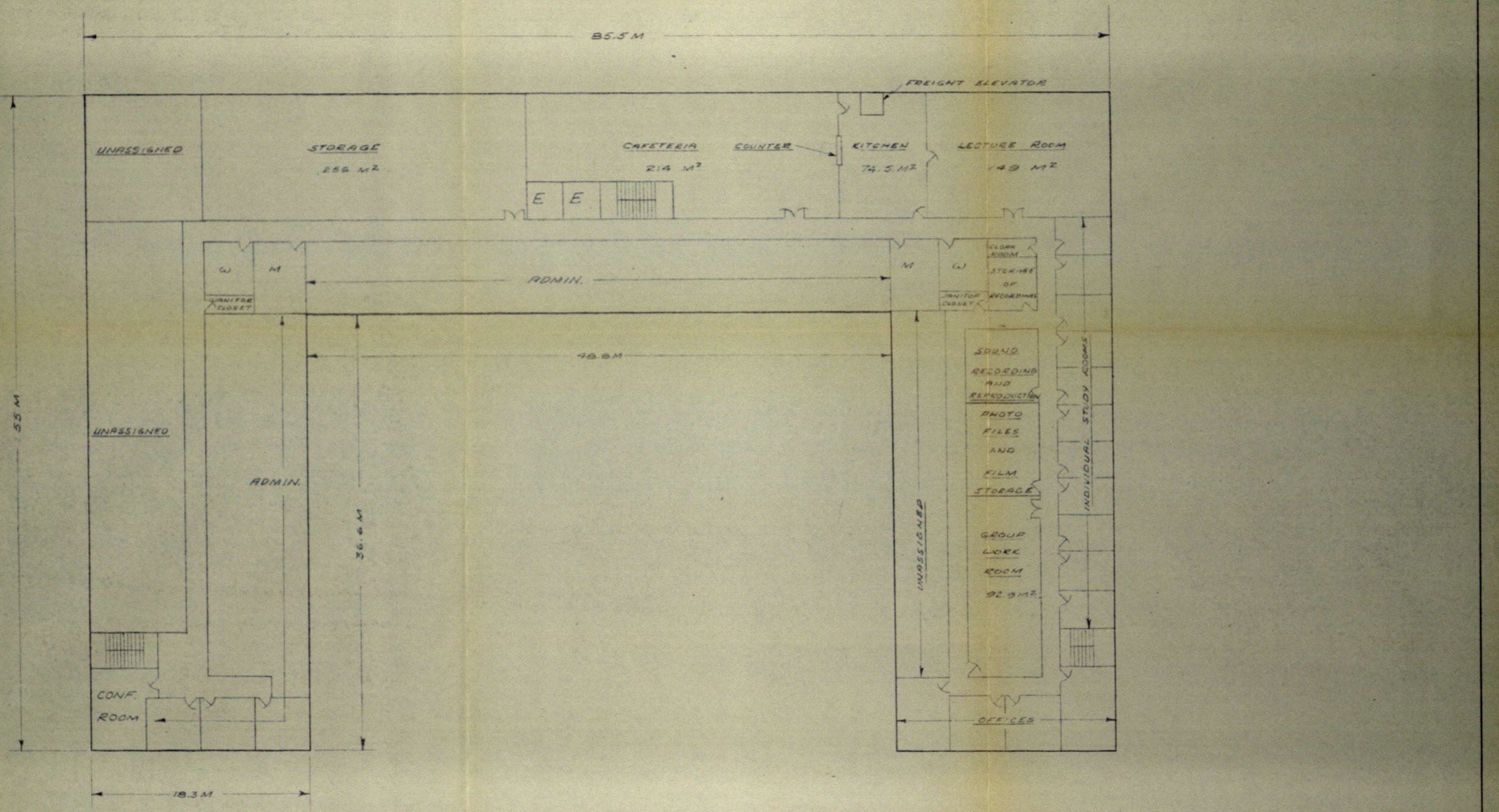
SCALE 1:240	APPD	



THIRD FLOOR

SCALE 1:240

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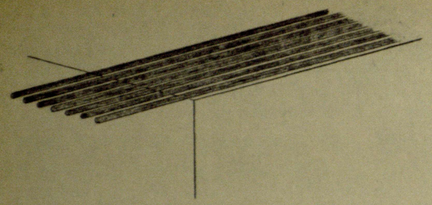
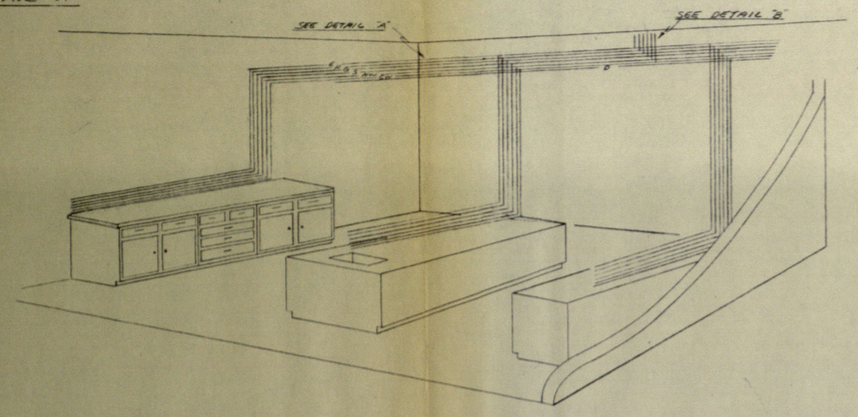
CLIENT	CASE NO.
ROYAL HELLENIC RESEARCH FOUNDATION	63797

THIRD FLOOR

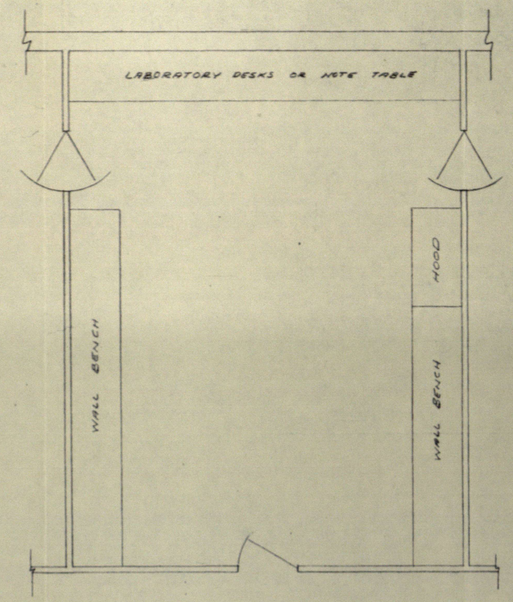
DWN J.L.N.	CHKD	
DATE MARCH 1962	APPD	CL 430
SCALE 1:240	APPD	



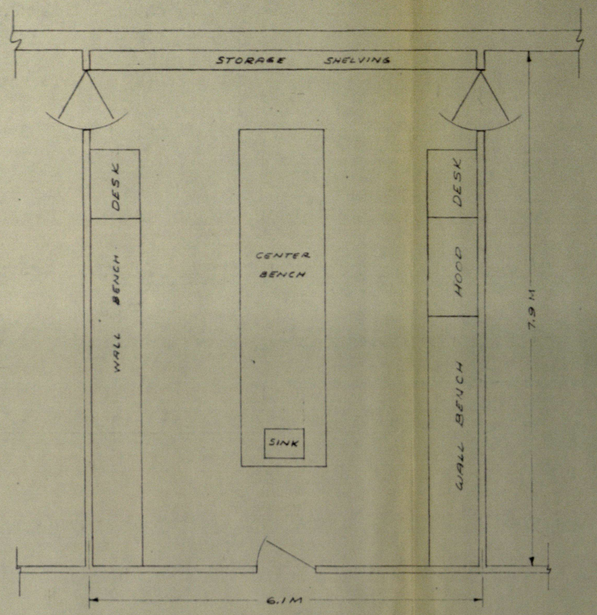
DETAIL "A"



SIMPLE ISOMETRIC OF TYPICAL LABORATORY



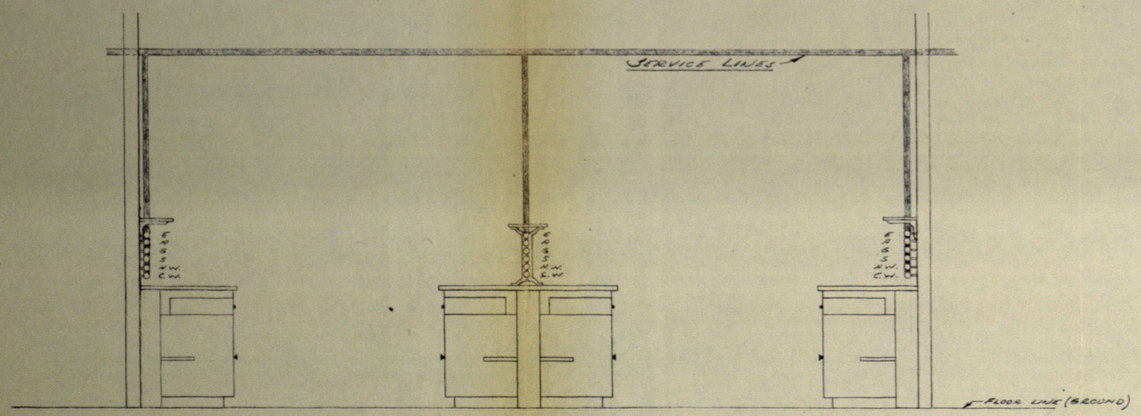
NO. 2



NO. 1

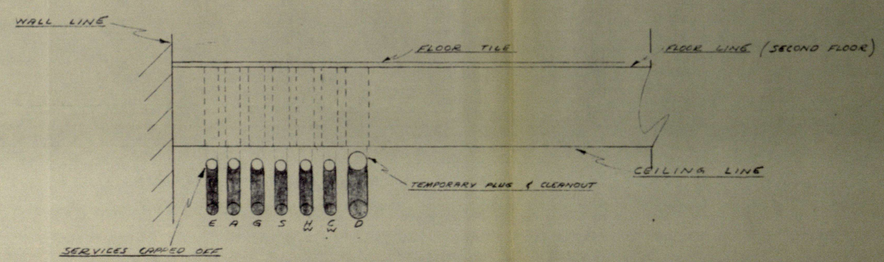
TYPICAL LABORATORY LAYOUTS

SCALE: 1:48



SECTION THROUGH TYPICAL LABORATORY

SCALE 1:24



NOTE: DOTTED LINES ARE SLEEVES THROUGH WHICH RISERS FOR FUTURE SERVICES MAY BE RUN.

DETAIL "B"
SCALE 1:12

SERVICE CODE
E. = ELECTRIC
A. = AIR
G. = GAS
H.W. = HOT WATER
C.W. = COLD WATER
S. = STEAM
D. = DRAIN

Allowable tolerances unless otherwise specified: decimal ±.005, fractional ±1/64, angular ±1°. This drawing is not to be used for making reproductions thereof, or for making any apparatus, without written authorization of Arthur D. Little, Inc. first obtained. All Prints to be returned to Arthur D. Little, Inc., immediately upon completion of work.

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ARTHUR D. LITTLE, INC.
CAMBRIDGE, 42 MASSACHUSETTS

CLIENT	CASE NO.
ROYAL HELLENIC RESEARCH FOUNDATION	63797

BENCH & SERVICE LAB. DETAILS

DWN	R.P.M.	CHKD	
DATE	NOVEMBER 1952	APPD	
SCALE	AS NOTED	APPD	DL 431

Arthur D. Little, Inc.

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