

The University Corporation for Atmospheric Research

and

The National Center for Atmospheric Research

1960 - 1970

AN INSTITUTIONAL HISTORY

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## PREFACE

A study of the development of the University Corporation for Atmospheric Research and the National Center for Atmospheric Research is of interest to the historian for a number of reasons. First, a corporation composed of universities, rather than individuals, with its Board of Trustees consisting of both scientists and administrators was a unique structure in 1959. Second, there was its ability to maintain independence and to change structure despite outside pressures and internal differences in opinion. These and other features make UCAR and NCAR stand out among contemporary scientific institutions.

In 1970 the Board of Trustees decided to commission the writing of the history of UCAR and NCAR. The desire of the Board and president of UCAR was not only an exposition of the development of the organization but also the preservation of some of the details of this development while they remained in living memory. To meet these goals, the author produced the narrative history which follows as well as a series of tape-recorded interviews with a number of persons involved in the early activities of UCAR.

The written history begins with the immediate events leading up to the formation of the University Committee on Atmospheric Research in 1958. The decision of UCAR to admit international members in 1969 provided both a convenient and significant terminus ad quem. These two points in the development of UCAR and NCAR bracket the first, and crucial, phase of their evolution.

It is hoped that this work will be the first part of a continuing written history of UCAR and NCAR which will be periodically updated. This project will serve the dual purpose of acquainting those outside, or new to, the organization with its background and of providing an in-house guide to the chronology of the corporation with references to the corporate records.

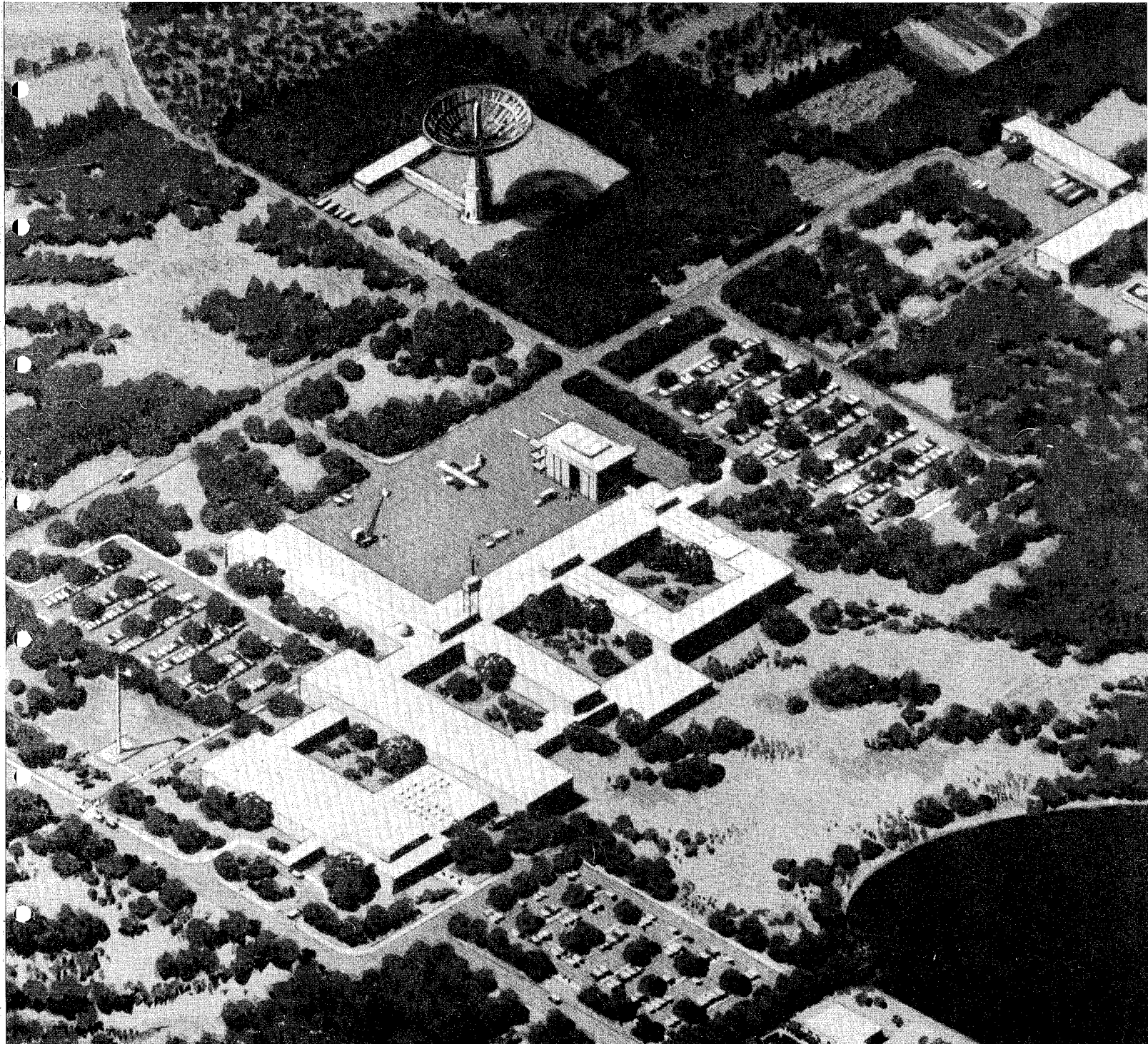
The author wishes to thank the numerous members of the NCAR staff who were so helpful, both in finding material and in recalling details, and the many trustees, past and present, who generously granted interviews which were rich in information.

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Artist's conception of the proposed National Institute  
for Atmospheric Research, from the "Blue Book," 1959



## CHAPTER I

THE UNIVERSITY COMMITTEE ON ATMOSPHERIC RESEARCH

In early 1956, Detlev W. Bronk, President of the National Academy of Sciences (NAS), appointed a committee of the National Research Council (NRC) to " . . . consider and recommend means by which to increase our understanding and control of the atmosphere . . . ." [1] This Committee on Meteorology (COM), organized in April 1956, consisted of Lloyd V. Berkner and Carl G. Rossby\* (cochairmen), Horace R. Byers, Henry G. Booker, Jule G. Charney, Hugh L. Dryden, Carl Eckhart, Paul E. Klopsteg, Thomas F. Malone, John von Neumann,\* and Edward Teller.

The committee early recognized that the problem of progress in meteorology was closely related to that of education and personnel resources in the field, hence two separate groups were set up to work in these areas. Discussion meetings, conferences with educators, and technical sessions with research workers in meteorology and related fields were held on a wide range of related subjects.

An interim report issued on 25 January 1958 included the following findings and recommendations:

1. The findings with respect to research were that there was a lack of stability in support for research; that government funding often tended to be detrimental to basic research; that present research was too fragmented; that the nature of the problems required interdisciplinary effort and large-scale equipment. These findings led to recommendations that present support for basic research be increased 50 to 100% and that a National Institute of Atmospheric Research (operated by a corporation of universities under a prime contract with the National Science Foundation) should be established.
2. The findings with regard to education were that university meteorological curricula and textbooks needed revision and improvement, that scholarships and fellowships were inadequate, that much needed to be done

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\*Deceased in 1957, before completion of the committee's work.



on the pre-university level; that the Weather Bureau education program could be expanded; and that there was a desire on the part of universities with meteorological departments to band together to effect programs to promote the present surge of growth in the science. The recommendations derived from these findings were that an inter-university committee be formed to consider curricula, student recruitment, fellowships, and textbooks; that this committee or a similar one offer help to the Chief of the Weather Bureau in the Bureau's educational and recruitment programs; and that it acquaint itself with the availability of fellowships and scholarships and guide well-qualified students to such sources of assistance.

3. The basic findings in personnel resources were that 90% of all working meteorologists were government employees; that the percentage of meteorologists with doctor's degrees was the lowest of any major scientific group, while the percentage of persons with no degree at all who were designated as meteorologists was the highest of any major scientific group; and that a disproportionately large number of meteorologists were World War II veterans. The only recommendation was that the American Meteorological Society (AMS) should greatly increase its activities in stimulating interest in meteorology and should seek federal funds for the purpose. [2]

An informal planning conference was held on 31 January 1958 to discuss the substance of the report of the Committee on Meteorology, and, in particular, to exchange ideas on the advisability of the establishment of a National Institute for Atmospheric Research. Present at the meeting were:

Thomas F. Malone, Travelers Insurance Company Research  
Center, Committee on Meteorology, Chairman  
Jule G. Charney, Massachusetts Institute of Technology,  
Committee on Meteorology  
Paul E. Klopsteg, National Science Foundation, Committee  
on Meteorology  
Edward Teller, University of California at Los Angeles,  
Committee on Meteorology  
Werner A. Baum, Florida State University  
Reid A. Bryson, University of Wisconsin  
Horace R. Byers, University of Chicago  
Phil E. Church, University of Washington  
Richard Courant, New York University

Bernhard Haurwitz, New York University  
 Leland J. Haworth, Brookhaven National Laboratory  
 Seymour L. Hess, Florida State University  
 Solomon C. Hollister, Cornell University  
 Henry G. Houghton, MIT  
 A. Richard Kassander, Jr., University of Arizona  
 Joanne S. Malkus, Woods Hole Oceanographic Institution  
 Morris Neiburger, UCLA  
 Sverre Petterssen, American Meteorological Society  
 Francis W. Reichelderfer, United States Weather Bureau  
 Roger Revelle, Scripps Institution of Oceanography  
 T. P. Wright, Cornell University

The consensus of the meeting was approval for a national institute, despite the possibility that it might initially draw staff away from the universities. The only opposition came in a statement by Columbus O'D. Iselin of the Woods Hole Oceanographic Institution who felt that it was unwise to push ahead with such an institute at that time. Other general points raised by members of the meeting included the need for large-scale (global) operations, the need for government funding, the fear of the military coming to dominate the field of meteorology, and the need for close connections between the institute and the universities. The conference passed the following resolution:

Resolved: It is the sense of the assembled representatives of universities and kindred institutions engaged in meteorological, oceanographic, and related research and teaching, that the interim report of the Committee on Meteorology of the National Academy of Sciences be endorsed; that present support for basic research in meteorology at academic and related institutions should be substantially increased; and that a national institute for atmospheric research, operated by an association of universities, should be established to bring together scientists from meteorology and the related physical sciences and to provide research facilities on a scale required to cope with a global nature of the meteorological problem. It is further requested that appropriate organizational steps for establishing such an institute be taken immediately by the National Academy of Sciences, acting in concert with the universities and kindred institutions. [3]

On the advice of Byers, Houghton sent a letter on 14 February 1958 to all chairmen of departments of meteorology with active programs

calling a meeting for later in the month. The purpose of the meeting was to set up the organization of the informal group attending the meeting and to consider means for implementing the proposals of the Committee on Meteorology in its interim report, in particular those proposals relating to an increase in research effort at universities and to the formation of a National Institute of Atmospheric Research (NIAR). [4] The meeting was held 26-28 February 1958 at UCLA and was attended by:

Henry G. Houghton, MIT, Chairman Pro Tempore  
 Reid A. Bryson, University of Wisconsin  
 Horace R. Byers, University of Chicago  
 Robert G. Fleagle, University of Washington  
 Seymour L. Hess, Florida State University  
 A. Richard Kassander, University of Arizona  
 Dale F. Leipper, A&M College of Texas  
 Morris Neiburger, UCLA  
 Hans Neuberger, Pennsylvania State University  
 J. Robert Stinson, Saint Louis University  
 Thomas F. Malone, Travelers Insurance Company  
 Research Center, NAS-NRC Committee on Meteorology

General discussions were held on the problems of funding research, the concepts involved in NIAR, and the problems of increasing the number of trained personnel in the field of meteorology, in particular the lack of financial support. Houghton was formally made chairman of the group. An executive committee, responsible for getting support for the group and speaking for the group (in particular, consulting with Bronk, NAS President, and other specialists in Washington), was formed with Neiburger and Byers as members. Working study groups were appointed by the chairman:

Working Group on University Research:

D. F. Leipper, Chairman  
 B. Haurwitz  
 J. London (alternate)

Working Group on Manpower:

S. L. Hess, Chairman  
 H. Neuberger  
 J. R. Stinson

Working Group on NIAR:

R. A. Bryson, Chairman  
 P. E. Church  
 R. G. Fleagle (alternate)  
 A. R. Kassander

The group constituted itself the University Committee on Atmospheric Research (UCAR) and decided to ask the following university representatives to join the committee and to be present at the next meeting (set for 28-29 March at Madison, Wisconsin):

George S. Benton, Johns Hopkins University  
 J. Vern Hales, University of Utah  
 E. Wendell Hewson, University of Michigan

It was proposed by the Working Group on University Research that a letter be sent to the chairmen of all departments of meteorology and kindred departments and institutions, requesting information on the numbers and type of their research personnel, research funds, and laboratory facilities. The recipients of these letters would also be asked to state what they would like to see done to strengthen and expand the atmospheric research program in their institutions. Such a letter was subsequently circulated by Houghton on 10 March 1958.

The major recommendation of the Working Group on Manpower was for a large increase in fellowship programs, to be funded by the National Science Foundation (NSF) and operated by the universities. They further recommended the institution of visiting lectureships, an increase in the Weather Bureau's upgrading program, and the development of long-range programs dealing with high schools and secondary science teachers.

The Working Group on NIAR defined NIAR's purpose as an attack on fundamental atmospheric problems on a scale commensurate with their global nature and importance. Its unique properties and functions would be to:

1. Preserve a natural alliance of research and education without unbalancing university programs.
2. Provide technological aid in sufficient variety, scope, and competence for an efficient attack upon the problem.

3. Provide a focal point toward which the intellectual competence of the various disciplines might be directed for the solution of fundamental problems.

This group also presented a possible organizational structure for NIAR, as well as its financial and personnel requirements. [5]

A proposal for a "Study of Means for the Augmentation of the National Effort in Atmospheric Research," was submitted to NSF by Houghton on 20 March 1958, through MIT. Funds (estimated at \$52,400) were requested for the support of UCAR's activities for a 16-month period beginning on or about 1 May 1958. In the interim, expenses were met by NAS, since UCAR was considered to be carrying out the recommendations of the NAS-NRC Committee on Meteorology.

The next meeting of the University Committee on Atmospheric Research was held at the University of Wisconsin on 28-29 March 1958 and was attended by:

- H. G. Houghton, MIT, Chairman
- R. A. Bryson, University of Wisconsin
- G. S. Benton, Johns Hopkins University
- H. R. Byers, University of Chicago
- P. E. Church, University of Washington
- B. Haurwitz, New York University
- S. L. Hess, Florida State University
- D. F. Leipper, A&M College of Texas
- M. Neiburger, UCLA
- H. Neuberger, Pennsylvania State University
- Benjamin Nichols, Cornell University
- J. R. Stinson, Saint Louis University
- T. F. Malone, Travelers Insurance Company Research Center, NAS-NRC Committee on Meteorology

Chairman Houghton reported on activities of the Executive Committee since the last meeting. Bronk and Berkner had been informed of the plans of UCAR. Berkner had urged Reichelderfer, Chief of the U.S. Weather Bureau, to set up an inter-government department committee to whom UCAR would report so that motion would be initiated for funding proposals for an increased atmospheric research program and the establishment of NIAR.

In discussions with other members of government agencies, Houghton had learned that the Department of Defense (DOD) planned to place

approximately 50% of its atmospheric research funds with the universities. The Geophysical Research Directorate (GRD) and the Office of Naval Research (ONR) were of the opinion that funds might be even less than before. Earl G. Droessler\* had indicated to Houghton that additional funds in meteorology had been made available to DOD, GRD, ONR; there was an estimated increase of approximately 25% in basic atmospheric research funding.

On the question of oceanography within NIAR, Byers had talked with Revelle of Scripps Institution of Oceanography, and Houghton with Iselin of Woods Hole. Revelle felt that NIAR should have strong associations with other fields of geophysics--particularly oceanography--and that NIAR should be located near a university and should be similar to an academic institution in nature. Iselin generally agreed that physical oceanographers work with problems similar to those in atmospheric research; he agreed to bring up the COM report and UCAR at the next meeting of the Committee on Oceanography (COO). He further suggested that Harrison Brown, Chairman of COO, be asked to consider oceanographers who would be suitable members of UCAR to represent oceanography.

A discussion of the purpose and philosophy of NIAR then followed. There was general agreement that the purposes of NIAR should be to stimulate a rapid expansion in research, to tackle problems too large for the universities, and to provide a pool of meteorologists. Discussion also focused on the question of whether NIAR should be a facilities laboratory or a "think tank" (along the lines of Princeton's Institute for Advanced Study), or if these two types of facility were, in fact, incompatible. The problems of attracting personnel and of the possibility of fragmentation into separate disciplines were also considered.

Chairman Houghton called for a preliminary report by UCAR to be prepared within the next month. The report was to be broad, yet

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\*Of the Department of Defense; later in the year he became Program Director for Atmospheric Science at NSF.

contain specific recommendations. It would be circulated to key people in Washington (NAS, NSF, DOD, etc.), and would be followed up with visits by members of UCAR designed to help initiate the funding process in the various government departments.

The working groups then presented their reports. The manpower group reported that NSF fellowships could not be specifically designated for any one field and that universities were already not getting enough qualified students to fill their available assistantships. Furthermore, NSF was already sponsoring a lectureship program, primarily on the college level. Discussions with Weather Bureau personnel brought out the main problems they had encountered in trying to upgrade their educational program--lack of money and lack of personnel. A motion was carried that UCAR (as the AMS Committee on Meteorological Education) recommend to the AMS Executive Committee that AMS submit a proposal to NSF for a full-time lectureship to start in the fall of 1958. [6]

The university research group report was based on information from the universities that had been requested earlier in the month. The fifteen responses indicated that there was an immediate need for a 20-40% increase in funds for cost of living increases, supplemental programs, and the rounding out and development of sound overall programs. Longer range needs indicated an increase of 60-80% in funds, in addition to the immediately needed increase, and an increase of approximately 100-125 professional people.

The NIAR group presented an outline of its section of the planned UCAR report. Besides statements on the necessity for such an institute, the types of problems that it would handle, technical aid, and intellectual competence, the outline included the following specifications:

1. The directorate was to be composed of university department representatives.
2. Emphasis was to be on basic research, especially those problems whose scale requires greater cost, time and facilities than universities can handle alone.

3. NIAR was to be a joint effort concentrating on the problems of many disciplines.
4. The staff was to be transient or quasi-permanent.
5. Advanced technical skills were to be directed toward atmospheric problems.

The report also included a tentative schedule of NIAR's stages of development over a reasonable period of time.

Further, this group recommended that, in order to implement initiation of NIAR in the first year, the UCAR planning group should begin by employing a nucleus staff for NIAR. This staff, including a director pro tem, would be for the purpose of starting the development of NIAR. [7]

During the month following the Wisconsin meeting (April), the working groups prepared their sections of the UCAR report. Concern was expressed over the proposed size of NIAR; both Houghton and Neiburger felt that the estimate of 300 people at NIAR by the end of five years was too high and would require stripping the universities of professional meteorologists. Byers (chairman of the Working Group on NIAR) responded by cutting the figure to 200 and pointing out that many of the personnel (computer people, electronics technicians, engineers, etc.) would not be meteorologists in any case.

Houghton attended, by invitation, the meeting of the NAS-NRC Committee on Oceanography (COO) on 26 April 1958. Byers had already expressed fear of hostility to NIAR on the part of COO, citing the concerns of Athelstan Spilhaus and Iselin. [8] However, Houghton felt that the overall tone of the COO meeting was encouraging, with general support for the concept of NIAR (Spilhaus was not present). Although there was also agreement on the necessity of close cooperation between COO and UCAR, no oceanographer was named to join UCAR, despite Houghton's suggestion.

During May, there was growing evidence that various areas of government, besides those immediately concerned, were becoming interested in UCAR and the problems of meteorology. Early in the month Senator Hubert Humphrey wrote to Houghton asking for his suggestions



for expanding activities in the field of weather research. The Governor's Conference, on 21 May, passed a resolution urging Congress to support the proposals presented to it by NSF to increase research in meteorology and specifically to support the establishment of NIAR.

The second meeting of UCAR was held 22-23 May at the National Academy of Sciences in Washington. Discussions of the draft of the First Progress Report with Klopsteg (Associate Director of NSF) clarified a number of points. Suggested modifications to the report included: a statement to the effect that some permanent NIAR staff would be necessary; an explicit statement concerning the interdisciplinary and international aspects of atmospheric research and NIAR; a fairly specific outline of some examples of research programs that would be considered for NIAR; and that the agencies to whom the report is directed should be kept in mind when writing it. It was generally considered undesirable to get all government support from one agency.

Hess, chairman of the Working Group on Manpower, reported on private foundation support for fellowships. The Ford Foundation did not grant fellowships at all. The Alfred P. Sloan Foundation might be receptive to the idea (of 10 fellowships of \$4000 each), but their board of trustees would need to be sold on it; letters of support from prominent scientists would help. The question of who would administer the fellowships also had to be considered.

In discussion on action to incorporate, it was decided that a statement should be prepared outlining the aims and objectives of a corporation to oversee NIAR and that Chairman Houghton should send a letter to the presidents of the various universities outlining the actions of UCAR, the need for a legal body to initiate further action, and suggestions for further action.

The committee then adopted the following resolution:

RESOLVED: That the University Committee on Atmospheric Research is to initiate proceedings leading to the establishment of a Corporation of Universities, each represented by a responsible scientific representative and by a responsible administrative officer, for the

purpose of putting into effect the recommendations of this committee.

There was some discussion of whether or not UCAR should continue to exist, as a committee, after the formation of the corporation.

The Working Group on NIAR presented an outline of proposed progress for the first three years of NIAR. With an initial planning staff of five, plus a director, and a scientific staff of five, plus assistants, feasibility studies and site acquisition for construction would be initiated during FY 1960. Houghton felt that the selection of the temporary planning staff should proceed simultaneously with the activity leading to incorporation.

Reichelderfer, Chief of the U.S. Weather Bureau, reviewed plans for the Weather Bureau research program. They had asked Congress for a supplemental appropriation of about \$10 million for programs in satellite instrumentation, experimental meteorology, radar programs, and aircraft squadrons. He thought it advisable for UCAR to give their progress report the widest possible circulation in order to rouse the tremendous latent interest in meteorology and weather.

The Chiefs of the Atmospheric Physics Branch and of the Meteorology Branch of the Air Research and Development Command reviewed the organization and programs of the ARDC and its atmospheric research organization. Concern was expressed by the committee over possible cuts in research funds to universities under Air Force grants.

The meeting concluded with a series of action assignments: a number of names were suggested for the lectureship program; Hess was to draw up a proposal to the Sloan Foundation for fellowships and to solicit the support of Bronk, Berkner and James R. Killian; Houghton was to sound out university administrations about incorporation and to set up an organizational meeting. [9]

On 3 June 1958 letters were sent to the presidents of the fourteen universities (with members on UCAR) outlining the activities of UCAR and the proposal for a corporation of universities to:

1. Employ a full-time staff to prepare specific proposals for submission to NSF.
2. Serve as contractor with NSF.
3. Serve as the governing board for the proposed NIAR.
4. Undertake the steps necessary to recruit scientific personnel and, in general, to publicize the program of atmospheric research.

The letters further invited the presidents to send representatives to an organizational meeting. All of the universities agreed to send representatives to the meeting; the replies ranged from strong enthusiasm on the part of Raymond B. Allen, Chancellor of UCLA, to definite reservations on the part of P. Stewart Macaulay, Provost of Johns Hopkins University.

Brown (COO) wrote to Houghton in late May suggesting oceanographers for the oceanographic member of UCAR and for a liaison between UCAR and COO. The whole idea was dropped, however, in view of the plans for incorporation. [10]

The First Progress Report of the University Committee on Atmospheric Research was brought out in June. While it reiterated many of the findings and recommendations of the Committee on Meteorology report, it concentrated more on the concerns of the universities rather than on the problems of the field of meteorology as a whole. Thus the UCAR report was devoted almost entirely to the problems of graduate research at the universities and NIAR. The latter half of the report covered NIAR--the reasons for its necessity and utility, cost estimates, and a tentative schedule (calling for full operational status by 1965).

The reasons for NIAR were summarized:

1. The need to attack fundamental atmospheric problems on a scale commensurate with their global nature.
2. The facilities necessary for such an attack were beyond those available to individual universities.

3. The difficulties of the problems required a coordinated, interdisciplinary approach on a scale not possible in a university department.
4. An institute would offer the possibility of an alliance between research and education, without unbalancing the university departments.

While similar in nature to the report of the COM, this report stressed the necessity of an institute--in that it could undertake those basic problems which could not reasonably be undertaken by individual universities.

The principles which would govern the operation of the institute were considerably broadened and expressed in more detail than in the COM report. Two of the basic recommendations from the COM--that the institute be interdisciplinary and that it be operated by a group of universities--were retained. This report further agreed with the COM report that funding should come from the federal government through NSF. Four other points made by the UCAR report concerning the operation of NIAR were:

1. Emphasis should be on basic research--particularly that beyond the capabilities of individual university departments.
2. The institute should organize its activities to support and strengthen the programs of the universities.
3. The major portion of the scientific staff should be transient or only quasi-permanent.
4. The advancement of capability for the measurement of atmospheric variables should be a major effort of the institute.

The report went on to recommend the formation of a corporation of universities to initiate the planning and operation of the institute.

The cost estimates were somewhat lower than those of the COM report, calling for an initial \$50 million and \$10 million annually thereafter. The report provided a general summary of the thinking of

UCAR and its working groups as it had developed in the course of their meetings and discussions.

The grant of funds from NSF for the support of UCAR's activities (applied for by Houghton in March) was approved in June. Also in June Klopsteg, Associate Director of NSF, told a meeting of the NAS Committee on Meteorology that NSF was willing to extend substantial support for basic atmospheric research for FY 1959, provided that good research proposals were received.

The first meeting for the purpose of organizing the corporation was held at Pennsylvania State University on 18-19 July 1958. The fourteen universities with members in UCAR all sent administrative and scientific representatives. Chairman Houghton explained the need for expanded research in atmospheric science, what UCAR was and what it had done, and the necessity of forming a legal corporation to handle NSF or other contracts. Since the main proposal to NSF would be for NIAR, he gave assurances of UCAR's concern for, and NSF's willingness to provide for, additional university research.

A Subcommittee on Organization Procedure (Gilbert L. Lee Jr., chairman, Carl F. Floe, William B. Harrell, Morris Neiburger, Albert W. Peterson, and Sidney G. Roth) drew up a draft of an Agreement for Cooperation in Atmospheric Research and a resolution which endorsed the agreement. The resolution was adopted by the meeting. Since the agreement required the approval of the governing bodies of the universities, it was specified that it would not go into effect until seven parties had signed it. The agreement called for the organization of a nonprofit corporation for the purpose of promotion of research in atmospheric science by:

1. Fostering support of research at the universities.
2. Developing personnel resources in the area.
3. Organizing and operating a National Institute of Atmospheric Research.

4. Assisting institutions and individuals in their development and progress in atmospheric research and related fields.
5. Fostering and encouraging advancement of knowledge concerning the atmosphere in all of its aspects together with the education and training of personnel in this field.

Further, the agreement named Houghton as temporary chairman of the Organization Committee (to be composed of an administrative and a scientific member from each of the signing parties) and set a membership fee of \$2500 for each signing party.

A subcommittee to draft the documents for the establishment of the corporation (articles of incorporation, bylaws, final draft of the agreement for cooperation) was appointed: G. L. Lee Jr. (chairman), A. W. Peterson, H. M. Byers, and M. Neiburger. It was also agreed at the meeting that members of UCAR should submit suggestions of objective criteria for the site of NIAR to Houghton. When these suggestions were all in, he would then appoint a subcommittee to prepare an integrated draft of these criteria. Suggestions of actual sites or site surveys were deemed inappropriate at that time.

Copies of the resolution and the agreement for cooperation in Atmospheric Research were sent to the executive officers of the universities on 21 July in order that the documents might be checked over by the universities for their legal acceptability and that approval of membership might be sought from the governing bodies of the universities. By the end of July, Chicago, Wisconsin, and Texas A&M had all approved the agreement.

Chairman Houghton wrote to the Secretaries of Defense and Commerce, during July, urging them not to concentrate all of their research funds in NIAR if the institute was formed. He later received assurances from them that, in principle, their departments intended to continue their general support of all types of research institutions.

Dr. Malone, Director of Research for the Travelers Insurance Company and Secretary of the American Meteorological Society, agreed

to serve as executive director pro tem of UCAR. His task was, with a small staff, to prepare the initial proposals for NIAR. By early September Malone had assembled his planning staff: William S. von Arx of Woods Hole, Jule Charney of M.I.T., and Roscoe R. Braham Jr. of the University of Chicago; they would serve on a full or part-time basis through the end of the year. Under Malone's direction UCAR sponsored a number of research planning conferences designed to provide proposals for basic research which might be undertaken at NIAR. These conferences consisted of a small group of scientists, usually about six, meeting for two days at a time to discuss specific topics such as cloud physics, radio meteorology, atmospheric chemistry, etc. [11] These conferences drew on a total of more than 150 scientists.

By mid-September the required minimum of seven universities had approved the agreement for cooperation and four others reported that they expected to receive approval from their governing bodies within the month. Florida State University and the University of Washington found that they could not legally join such a corporation at that time. Several of the universities found that minor changes in the agreement were necessary to meet their legal requirements. By mid-October, the final form of the agreement was drafted and distributed to the universities for the signatures of their executive officers.

A formal public announcement of the plans for the corporation was made on 9 October 1958 at the New York Board of Trade dinner, which was featuring meteorology that year. Besides the speech by Houghton, on that occasion, statements in support of NIAR and their participation in it were issued by the executive officers of the twelve universities involved.

Since planning had gone faster than anticipated, more funds were needed for a study of facilities which would require conferences with consultants and research scientists. This study was to result in realistic cost estimates and a fairly complete plan for NIAR. Consequently a proposal for more funds (\$74,750 for the period December 1958 to June 1959) for preliminary planning of NIAR was submitted to NSF in

October. Earlier a proposal had been submitted to the Alfred P. Sloan Foundation for \$45,000 for a fellowship program to provide ten fellowships of \$4000 each. It was further proposed that the administration of the fellowship program be handled by the corporation.

The subcommittee to draft the incorporation documents completed drafts of the bylaws and part of the articles of incorporation (only that section concerning the purposes and objectives of the corporation; a complete set of articles would have been pointless until the state of incorporation had been decided upon) in early November. These documents were then submitted to the executive officers of the universities for their review and suggestions. Copies of the agreement for cooperation had been submitted to these officers for their signatures in October, and since signed copies of the agreement had been received from more than seven of them by this time, a request for the \$2500 membership fee was also sent to them. In the same letters the first meeting of the Organization Committee was called for 5 December 1958 at the University of Michigan.

The organization meeting was attended by two representatives from each of the twelve universities which had signed the agreement for cooperation as well as by representatives of Florida State University, the University of Washington, the American Meteorological Society, and members of the UCAR planning staff. The first business of the meeting was a decision on a name for the corporation. After some discussion, the name decided upon was the University Corporation for Atmospheric Research, Inc.

A general discussion of the draft of the bylaws led to a number of changes, largely in nomenclature; e.g., the governing body, originally called the Board of Directors, was changed to the Board of Trustees. The resulting governing structure of the corporation was then a Board of Trustees consisting of two trustees from each institution, one scientific and one administrative, to be designated by the executive officer of the institution, and no more than five trustees-at-large to be elected by the Board at their annual meetings. The trustees-at-large were



excluded from serving as officers of the corporation and from serving a second consecutive term. Their terms would normally be three years, while the institutional trustees would serve at the pleasure of the executive officers of their institutions. The Board of Trustees would have the powers and responsibilities of carrying out the business of the corporation. It would meet twice a year with the meeting in October designated as the annual meeting.

An executive committee consisting of nine members elected by the Board and the chairman of the Board ex officio would have immediate control of the corporation, acting in place of the Board when it was not meeting. There would be no more than one member of the Executive Committee from each institution and no more than one trustee-at-large on the committee. The committee would meet as necessary, but no less than four times per year.

A Nominating Committee of three members would be elected by the Board at each annual meeting. This committee would propose nominees for positions as officers of the corporation and members of the Executive Committee. Other committees might be appointed by the Board as it was deemed necessary.

The officers of the corporation would be the chairman, vice-chairman, a secretary, a treasurer, and a director. The director would be the principal executive officer of the corporation. The chairman and vice-chairman would be trustees and would serve three-year terms. The secretary, treasurer, and director would not have to be trustees.

Amendments to the bylaws could be carried out by a two-thirds majority vote of all the trustees entitled to vote. [12]

Following the adoption of the bylaws, as amended, there was a general discussion of the draft of the article relating to the purposes of the corporation. There was no action taken on the article; it was the consensus of the meeting that the purposes of the corporation should include the purposes as stated in the agreement for cooperation.

A committee was appointed to carry out the necessary actions to form the corporation. The committee was empowered to appoint legal counsel, decide on the state of incorporation, expend funds, finalize the wording of the articles of incorporation and of the bylaws, and to do anything else necessary for incorporation. Members of the committee were: H. G. Houghton (chairman), H. R. Byers, G. L. Lee Jr., A. W. Peterson, and Michael A. Farrell.

The chairman was authorized to appoint a nomination committee. This committee, appointed late in December, consisted of M. Neiburger (chairman), G. Benton, and W. Harrell.

In December Houghton engaged John M. Woolsey Jr. of Herrick, Smith, Donald, Farley, and Ketchum (of Boston) to act as legal advisor in the incorporation procedure. Woolsey rewrote the bylaws to clear up various legal points and specifically to ensure that the corporation would qualify for tax-exempt status with the Internal Revenue Service. He left the objects and purposes of the corporation broad for the sake of facilitating any possible future change in activities. A draft of the certificate of incorporation and of the bylaws was provided early in January. Woolsey strongly advised that Delaware be the state of incorporation since procedures there were well established, relatively simple and inexpensive, and since no site had yet been chosen for NIAR. The actual incorporators would have to be individuals rather than institutions since most institutions had legal restrictions against such activities.

An additional planning grant of \$50,000, requested in October, was approved by NSF at the end of December. Other UCAR business in December and January was concerned with the lectureship series and the fellowship program. By January twelve lecturers had agreed to participate in the AMS lectureship program and fifty colleges had requested lecturers. An executive assistant had been established in the AMS headquarters to take care of the details of the program. The fellowship program was underway with 2500 announcements being sent out in January to various institutions.

A Fellowship Award Committee was named, consisting of: H. Neuberger (chairman), James M. Austin, and Jerome Spar, with two more members to be named.

Malone and his staff had attempted to complete preparation of the report and budget to be submitted to NSF in time for presentation to the meeting of the National Science Board on 23 January 1959. Houghton was anxious to have at least a preliminary report presented to the NSB at this time since their next meeting would not be until March. However, the committee to review and coordinate the preparation of the report and budget, appointed at the Pennsylvania State meeting (consisting of T. P. Wright, P. S. Macaulay, and W. B. Harrell), strongly urged that the presentation be delayed until March so that a thorough review of the report might be undertaken by the committee and the other members of UCAR. [13] The committee met with the planning staff and Houghton on 30 January to review the report and budget in detail; both were then approved unanimously.

The report (Preliminary Plans for a National Institute for Atmospheric Research--Second Progress Report of the University Committee on Atmospheric Research, later commonly known as the "Blue Book") was submitted to the members of UCAR for review and suggestions and to the director of NSF as a preliminary report in the middle of February. This Second Progress Report reiterated and amplified the statements about NIAR of the First Progress Report, but also gave a more detailed description of possible scientific programs and preliminary plans. The research program was to be directed toward four broad areas of inquiry: atmospheric motion, energy exchange processes in the atmosphere, water substance in the atmosphere, and physical phenomena in the atmosphere. Fairly complete plans for the organization, facilities, and cost estimates of the institute were included. The cost estimates were higher than those of the First Progress Report; \$50 million for the first five years and \$13 million for an annual operating budget thereafter. [14]

The final form of the bylaws and certificate of incorporation were completed by the end of February. The actual incorporation was carried

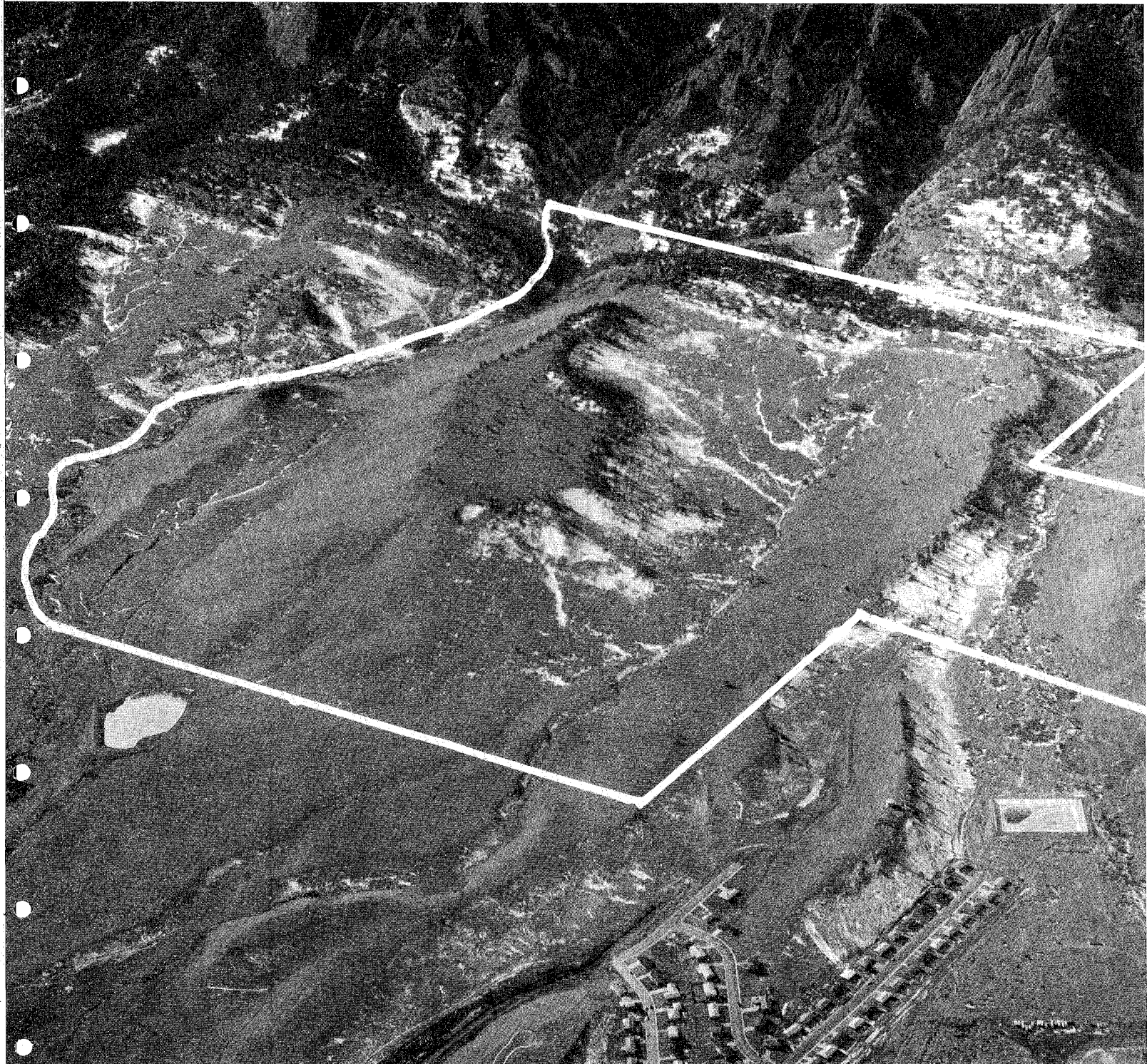
out by Houghton and the committee set up to prepare the incorporation proceedings (Byers, Lee, and Peterson by proxy). The certificate of incorporation was filed on 16 March 1959 in Dover, Delaware. The first meeting of the incorporators was held on 19 March to elect the original members of the corporation. Since Florida State's legal restrictions only prevented it from being an incorporator, it was elected an original member along with the other twelve universities. The date of the first Board of Trustees meeting was set for 2 April 1959.

NOTES

1. Statement by D. W. Bronk. 5 February 1958. Blue Book, Appendix C, C-1.
2. Research and Education in Meteorology: An Interim Report of the Committee on Meteorology, 25 January 1958. Blue Book, Appendix A, pp. A15-A23.
3. Minutes of the Committee on Meteorology Informal Research Planning Conference, 31 January 1958. Houghton Records, Microfilm I.
4. Letter from H. G. Houghton, 14 February 1958 and Minutes of the Informal Organizational Meeting of the University Committee on Atmospheric Research, 26-28 February 1958, p. 1. Houghton Records, Microfilm I.
5. Minutes of the Informal Organizational Meeting of the University Committee on Atmospheric Research, 26-28 February 1958. Houghton Records, Microfilm I.
6. S. Petterssen, President of the AMS, had asked UCAR to serve as the AMS Committee on Meteorological Education at some time prior to the Wisconsin Meeting (28-29 March 1958). Letter from E. W. Hewson, 21 April 1958. Houghton Records, Microfilm I.
7. Minutes of the First Meeting of the University Committee on Atmospheric Research, 28-29 March 1958, p. 17.
8. Letter from H. R. Byers to H. G. Houghton, 22 April 1958. Houghton Records, Microfilm I.
9. Minutes of the Second Meeting of the University Committee on Atmospheric Research, 22-23 May 1958. Houghton Records, Microfilm I.
10. Letter from H. Brown to H. G. Houghton, 28 May 1958. Letter from H. G. Houghton to H. Brown, 9 June 1958. Houghton Records, Microfilm I.
11. For a full list of the scheduled conferences, see Progress Report of T. F. Malone to Executive Committee, 4 September 1958. Houghton Records, Microfilm I. Also Blue Book, Appendix P.
12. Draft of Bylaws of the University Corporation for Atmospheric Research, Inc., 5 December 1958. Houghton Records, Microfilm I.

13. Letter from H. G. Houghton to T. P. Wright, P. S. Macaulay, and W. B. Harrell, 14 January 1959. Letter from P. S. Macaulay to H. G. Houghton, 19 January 1959. Letter from T. P. Wright to H. G. Houghton, 20 January 1959. Letter from G. S. Benton to H. G. Houghton, 21 January 1959. Houghton Records, Microfilm I.
14. Preliminary Plans for a National Institute for Atmospheric Research --Second Progress Report of the University Committee on Atmospheric Research (Blue Book), February 1959.





Aerial view of the site chosen for the permanent  
laboratory of the National Center for Atmospheric Research





## CHAPTER II

THE ESTABLISHMENT OF THE NATIONAL CENTER  
FOR ATMOSPHERIC RESEARCH

The first Board of Trustees meeting of the University Corporation for Atmospheric Research was held in Tucson, Arizona, on 2 April 1959. On the recommendation of the Nominating Committee, the following officers of the corporation were elected for three-year terms:

Henry G. Houghton: Chairman  
 Horace R. Byers: Vice-Chairman  
 Michael A. Farrell: Secretary-Treasurer

Three trustees-at-large were elected:

Walter Orr Roberts: Three-year term.  
 Thomas F. Malone: Two-year term.  
 Henry M. Stommel: One-year term.

Nine trustees were elected to the Executive Committee:

Three-year Terms:  
 Theodore P. Wright  
 Horace R. Byers  
 A. Richard Kassander

Two-year Terms:  
 E. Wendell Hewson  
 Thomas F. Malone  
 P. Stewart Macaulay

One-year Terms:  
 Dale F. Leipper  
 James E. Miller  
 Werner A. Baum

Staggered terms were set in this election only so that no more than two vacancies would normally occur at one time among the trustees-at-large and no more than three on the Executive Committee.

A major item on the agenda of this meeting was the discussion of the selection of a director for the institute. It was pointed out that while the director should basically be a scientist, it was also necessary that he have administrative ability, particularly since he would

play an important role in the development of the institute. The Board agreed that, provided the NSF funds became available, a full-time director should be employed as soon as possible after 1 July 1959. After a discussion of the procedures to be followed in selecting a director, it was moved that the officers of UCAR, ex officio, and the Nominating Committee work together in making nominations for the director. A nominating committee consisting of Byers (chairman), Wright, and Kassander was elected. Byers, in mid-April, circulated a letter to the trustees requesting their suggestions for nominees for the directorship.

A report was made to the Board on the fellowship program by Neuberger, chairman of the Fellowship Award Committee. Four fellowships had been awarded in March. There had been a total of fifty-nine applicants.

The chairman was authorized to appoint various committees to establish personnel policies for the institute, to consider the policy on the admission of new members to UCAR, and to define the criteria for the site of the institute. The latter committee, which became the site selection committee, or Site Committee, was also charged with recommending two or more areas for a site. In mid-May Chairman Houghton made the following appointments to these committees: Site Committee--W. A. Baum (chairman), J. Spar, W. B. Harrell; Personnel Committee--R. A. Bryson (chairman), C. F. Floe, J. M. Miller; Admissions Committee--T. F. Malone (chairman), P. S. Macaulay, G. L. Lee Jr.

In mid-May the House Appropriations Committee deleted the line item for the institute from the NSF budget. Only \$500,000 had been budgeted for this item, since the budget had been prepared months before. However, NSF had said that if the line item passed they could use additional funds from other parts of the budget for the institute, but they could not do so if the line item were deleted. Chairman Houghton urged all of the trustees, first, to work on the Senate Appropriations Committee to get the item restored and, second, to work on the Joint Conference Committee to keep it in the budget if it was restored.

Houghton testified before the Subcommittee on Independent Offices and General Government Matters on 5 June in support of funds for the institute and other atmospheric research. [1] The Senate restored the item for NIAR by the end of June. The House-Senate Conference Committee, by the end of the summer, also approved the restoration of the item. The final approval of the appropriations bill came in mid-September.

The National Academy of Sciences, in mid-July, endorsed the basic plan proposed by UCAR in UCAR's Second Progress Report--that is, the concept of a National Institute for Atmospheric Research.

Discussion of the choice of a director was again a major topic at the August Executive Committee meeting. The recommendations sent in by the trustees generally placed James A. Van Allen at the top of the list of possible nominees for the position. Byers had already informally approached Van Allen; he reported both that he was impressed with the man and that Van Allen seemed to be interested in the position. An ad hoc committee was formed to give due consideration to those members of the committee to select the director, as well as other trustees, whose names were on the list of suggested candidates for the directorship. The ad hoc committee consisted of all members of the Executive Committee with the exceptions of Houghton, Byers, Kassander, and Malone. The ad hoc committee agreed on Van Allen as their first choice. They further recommended that, in the event that Van Allen declined the directorship, the ad hoc committee, with the addition of Kassander and Macaulay, should be reactivated for the purpose of considering another nominee to present to the Board of Trustees. [2]

In early September the National Science Board (NSB) authorized NSF to contract with UCAR for \$500,000 (or less) to establish a small scientific staff for planning research programs and facilities (with the commitment to make every effort to cover the expenses of this group until 1965). The NSB report did not envisage a central research institute or even a concentration of facilities, rather it was felt that the central group should plan, stimulate and coordinate research programs, and provide facility management.

Further discussions by Houghton, Malone, and Baum with NSF personnel brought about the conclusion that the Blue Book schedule would have to be altered. Rather than having a small scientific group assembled to devote itself to planning the full institute, this group would have to start research planning and research at a temporary location. The NSB's reservations about having a central facility, rather than devoting all efforts toward expanded research in the universities, were reiterated. It was generally felt by the UCAR trustees, however, that nothing was basically changed and that aggressive action by UCAR would attain their objectives. [3]

In light of the NSB report the UCAR Board decided that a new proposal to NSF should be drafted that would be more in line with the NSB's desires. This proposal would put more emphasis on a research program rather than on large facilities but would still retain plans for a center for atmospheric research. The new proposal was, after review by the corporation's legal counsel and informal review by Dr. Randal M. Robertson of NSF, formally submitted to the NSF on 16 November 1959.

The Site Committee report to the Executive Committee in October recommended four broad areas for possible location of the center. The criteria for selecting these regions were their accessibility; a variety of weather phenomena; cultural, scientific, and intellectual suitability; and generally satisfactory living conditions. The four areas were:

- A quadrilateral enclosed by Cheyenne (Wyoming), North Platte (Nebraska), Amarillo (Texas), and Albuquerque (New Mexico); that is, eastern Colorado and northeastern New Mexico.
- A triangle enclosed by Minneapolis (Minnesota), Buffalo (New York), and Knoxville (Tennessee). That includes the greater part of Ohio and Indiana, large parts of Kentucky, Illinois, Wisconsin, and Michigan.
- A triangle enclosed by New York (New York), Buffalo (New York), and Burlington (Vermont). That is, most of New York state.

- A triangle enclosed by Chattanooga (Tennessee), Richmond (Virginia), and Wilmington (North Carolina). That includes most of North Carolina.

The committee further recommended that the Board narrow down the number of areas and that the committee then be instructed to select a specific locale within one of those approved areas. The Board accepted the report, but on the advice of W. A. Baum, chairman of the Site Committee, no action was taken. Baum pointed out that the NSB report had eliminated the necessity for speedy action with regard to the site for the center and that it would be advisable to wait until the director was chosen before a decision on the site was made. The Board agreed that the Site Committee should be reactivated by the chairman when appropriate. [4]

At the October Executive Committee meeting several amendments to the Site Committee report were made. One of the most long-lasting of these alterations changed the title from the National Institute for Atmospheric Research to the University Center for Atmospheric Research, in order to make the concept more palatable to the NSB and the NSF. The new NSF proposal, submitted in November, also used the term University Center for Atmospheric Research.

At the October meetings (held at Cornell University, 20-21 October 1959) the Admissions Committee made its report. Their recommendation was that the corporation be limited to sixteen members (the number was reduced to fourteen by the Executive Committee) for the immediate future. This recommendation was on the basis that any programs and facilities developed by UCAR would be readily available to non-members. It was understood and formally voted by the Board that the University of Washington would be elected as the fourteenth member as soon as it had resolved the legal problems barring its entry. It was the recommendation of the Executive Committee that the matter be reexamined in two years. The two major points in the debate over admissions policy, which recurred later, were clearly stated at this time. On the one hand, there was the need for a small, efficient management group, while

on the other hand, there was a need for having truly national representation on the Board of Trustees. [5]

Roberts resigned as trustee-at-large in September since he was going to become chairman of the NSF Advisory Panel for the Atmospheric Sciences and felt that his position would be stronger to help both the center and atmospheric research in general if he had no formal connection with an interested group such as UCAR. [6] At the October Board meeting Berkner was elected trustee-at-large to fill out Roberts' unexpired term.

The corporation's new counsel, Roy Wilkinson Jr., of Love & Wilkinson (Bellefonte, Pennsylvania) had visited Brookhaven (operated by Associated Universities, Inc.) in September 1959 to obtain information about their operations--particularly about tax-exempt status and personnel policies. He had already started the application procedure for tax-exempt status for UCAR by October.

The Personnel Committee made a preliminary report in October, having used the Midwestern Universities Research Association (MURA) and the Association of Universities for Research in Astronomy (AURA) as their models. Since their report covered only general employee benefits and restrictions, they were urged to set salary scales so that the director, when chosen, could immediately start to assemble his staff.

The Committee on the Nomination of a Director reported its activities, with a strong recommendation for Van Allen. The Board approved this recommendation and authorized the chairman to negotiate with Van Allen. However, shortly thereafter (6 November 1959), Van Allen asked to be withdrawn from consideration for the directorship. [7]

In view of Van Allen's refusal to reconsider his decision (he was urged to do so later in November), the ad hoc committee to the Nominating Committee was reactivated and met on 5 January 1960. The three members of the Nominating Committee, who had been proposed for the directorship, withdrew themselves from consideration for the position. The ad hoc committee then dissolved itself and the regular Nominating Committee carried on the meeting. [8] The committee decided

on four possible candidates for the directorship: Michael Ference Jr., Herbert Friedman, T. F. Malone, and W. O. Roberts. These men were contacted by, respectively, Byers (for the first two), Houghton, and Kassander. Houghton was conferring with Malone during the first half of February, while Kassander began serious discussions with Roberts during the latter half of the month. [9] By March both Malone and Ference had said that they would not accept the directorship if it were offered. Friedman had only been approached tentatively and had appeared to be only moderately interested. Kassander reported that Roberts was definitely interested in becoming director of UCAR.

The Committee for the Nomination of a Director reported to the Executive Committee at their regular meeting on 17 March 1960. After a discussion based on Kassander's interview with Roberts, the Executive Committee concluded that while some of his views were incompatible with the philosophy of UCAR, Roberts was still the best prospect for a director. The nomination committee was instructed to meet with Roberts and to " . . . determine whether his philosophy and viewpoints can be altered in order that he can serve as director in accordance with the philosophy and goals of UCAR, . . . ." [10]

Houghton, Byers, and Kassander (Wright and Farrell being unable to attend) met with Roberts for a lengthy discussion on 29 March 1960. They found themselves in basic agreement on the nature of the center: that it should be a strong central laboratory with its own research programs and a permanent staff and that it should not merely be a convenience facility for the universities. On the other hand, everyone agreed that university research should be encouraged. Roberts expressed to the committee his wish to remain in Boulder and to have UCAR absorb the High Altitude Observatory (HAO), if he were to be named director of UCAR. [11]

After the Executive Committee approved the report of the nomination committee, it was submitted to the Board of Trustees for action at their meeting on 26 April 1960. Roberts also appeared before this meeting to present his views and to answer questions of the trustees. The Board



unanimously voted to offer Roberts the appointment as director of the center. The chairman was authorized to appoint a committee to work out details of the continuing relationship of HAO to UCAR which would be satisfactory to all parties (including NSF).

The NSF contract was under discussion throughout this period. A rough draft presented by NSF at the March Executive Committee meeting drew the complaint from the trustees that the corporation appeared to be relegated to an advisory capacity rather than having a management role. The NSF representatives indicated that the draft would have many reworkings ahead of it and that the corporation would have a chance to review it and suggest changes in it. The draft presented to the April Executive Committee meeting had most of the previously noted undesirable items removed. At this meeting the draft was reviewed in detail and a six-page list of points, categorized in order of importance, was developed for the Negotiating Committee to take up with NSF. It was also suggested that the contract be compared with those of similar organizations.

A meeting between the Negotiating Committee (Houghton, Farrell, Macaulay, and Wilkinson) and NSF representatives to go over final points of the contract was held on 9 June. A final meeting was held on 20 June 1960 at which time the contract was signed. The NSF and UCAR corporate representatives had come to agreement on all major points except for the hold-harmless clause and the patents clause. The contract was approved by the Executive Committee at its 18 July meeting.

In April the one-year terms of three members of the Executive Committee (D. F. Leipper, J. M. Miller, and W. A. Baum) ended and R. A. Bryson, Rev. R. J. Henle, and H. K. Work were elected by the Board to fill these positions for three-year terms. A new Nominating Committee consisting of H. K. Work (chairman), R. A. Bryson, and W. E. Hewson was also elected. The Board at this time elected the University of Washington as the fourteenth member of UCAR.

The Site Committee, having been deactivated after its report of October 1959 on Baum's recommendation that the selection not be further narrowed until after a director had been chosen, was reactivated in

July 1960. The committee was charged with viewing sites in the Boulder area and with engaging engineering consultants who would determine how well these sites fitted the adopted criteria for NCAR and would recommend a specific first choice in the area. Baum, chairman of the Site Committee, came to Boulder in August and discussed the site situation with Director Roberts. After having conferred with several engineering firms Baum engaged Ken R. White, Consulting Engineers (Denver), to study and report on the suitability of several prospective sites. The sites were further examined for their architectural suitability by a local architect, Tician Papachristou, and for their adaptability to the requirements of the proposed radiation probing facility by a consulting physicist, Joseph H. Rush of Boulder. The consultants were directed to evaluate the sites not only with respect to each other, but particularly with respect to the criteria which had been developed by the Board, by the Site Committee, and as described in the "Blue Book."

The findings of the consultants clearly indicated that the Table Mountain site was the best prospective location for NCAR and that it also satisfied a high proportion of the site selection criteria which had been developed earlier. In October the full Site Committee met in Boulder with the director and the consultants and personally inspected the prospective sites. As a result of their deliberations and inspections, the Site Committee decided unanimously to recommend the Table Mountain site. This recommendation was submitted to the Executive Committee on 10 October 1960, which voted unanimously to adopt it.

The Board of Trustees of UCAR voted unanimously, on 11 October 1960, to adopt the above recommendations and to recommend to NSF that the Table Mountain site be acquired for the permanent headquarters of UCAR. [12]

The state of Colorado had already undertaken to provide the site once it was selected. [13] The Board wished to retain ownership of the site, but NSF insisted that it must be the sole owner.

By October Director Roberts had set up a business office for UCAR at Boulder in space in the HAO building on the University of Colorado campus, with a small staff. Robert J. Low was appointed assistant

secretary and assistant treasurer by the Executive Committee to act as business manager of UCAR. The NSF approved his position as business manager later in the summer. In October the Board approved Holland and Hart, attorneys, as represented by John L. J. Hart, as Colorado legal counsel for UCAR.

The Executive Committee, at its 10 October 1960 meeting, adopted Roberts' nomination of Philip D. Thompson as associate director. Thompson was currently a Lt. Col. in the Air Force stationed in Sweden; negotiations with the Air Force began immediately to have him reassigned to Boulder.

In a move toward furthering relations between UCAR and HAO, a meeting was held in early October among Judge William S. Jackson (chairman of the HAO Board of Trustees), Hart (member of the HAO Board), Houghton (chairman of the UCAR Board), and Wilkinson. From this meeting came the suggestion that HAO should be brought under UCAR as a separate arm, on a par with the center. The consensus of the Executive Committee meeting in October was that a merger should be worked out with HAO as a separate arm of UCAR financially, but with facility of movement of personnel and projects between HAO and NCAR and with the joint use of facilities. The advantage that the merger would provide in having a scientific program at the center immediately under way, since HAO was a strong research organization in an area of atmospheric research and had funding available from various sources, was pointed out. Both the Executive Committee and the Board realized that many complex problems would be involved in a merger. One problem would arise from the difference in financial arrangements for HAO and UCAR, and another from the close relationship between HAO and the University of Colorado (it was felt that in keeping with the philosophy of UCAR's relationship to individual universities, these ties would ultimately have to be terminated). The HAO Board had already suggested the possibility of joint members of the HAO and UCAR Boards, so as a first step in maintaining this closer contact Jackson was elected as a trustee-at-large of UCAR at the October meeting. In January Byers and Kassander were informally suggested to

Jackson as possible UCAR representatives on the HAO Board. Both were elected to the HAO Board later in the spring of 1961.

NSF had called for detailed financial plans for FY 1961 to be submitted by the end of October 1960. Items in the plans at this time included the basic program in Boulder, planning for the laboratory facilities, planning for a high altitude flight facility, the balloon program, and dynamical meteorology and atmospheric physics research programs. A more detailed statement through FY 1962 was prepared by January which included the HAO and a computing facility. Plans presented to the January Executive Committee meeting called for an additional \$450,000 to be requested for FY 1961 and \$1.5 million to be requested for FY 1962. (NSF already had \$500,000 of unexpended FY 1960 funds for NCAR, so they suggested that that amount be transferred to UCAR rather than the \$450,000 requested.) It was anticipated that \$6.5 million would be requested for FY 1963.

At the spring 1961 meetings of the Executive Committee the director presented a number of names of scientific personnel for approval. Among these were Thornton C. Fry to be appointed as a consultant to the director primarily concerned with computing facilities and administration; Daniel F. Rex as assistant director of NCAR; and Patrick Squires, James P. Lodge Jr., Vincent E. Lally, Peter Meyer, Aksel Wiin-Nielsen, and Andrew Skumanich to be appointed to the scientific staff. The director also announced that he had taken a second staff assistant, Edwin L. Wolff, in addition to Mary L. Andrews who had been with the UCAR office since it was established by Director Roberts.

By February Thompson had arranged with the Air Force to be assigned to NCAR as of July 1961 until his retirement from the Air Force in September 1962. During this period he would act as de facto associate director of NCAR.

NSF still remained quite firm in its demand that it should hold full title to the site. In a meeting among NSF officials, Roberts, Houghton, and Wilkinson, the NSF people pointed out that it would make their task of obtaining funds for NCAR, particularly construction funds,

insuperably more difficult if the site was not owned by the government. NSF did, however, have the power to make grants of real estate and would consider granting UCAR a portion of the site if a legitimate need was demonstrated. This need might arise in the event that UCAR was able to obtain private funds for projects not covered by the NSF contract. There were further assurances that the land could not be transferred to or used by another government agency.

On 31 January 1961 a referendum vote in Boulder approved the "Blue Line" amendment which would allow the city of Boulder to supply the site with water. Later in the spring the Colorado State Legislature voted \$250,000 for acquisition of the site. The land would be turned over to NSF with a reverter clause which would provide that the site would be returned to the state if it was to be used for purposes other than atmospheric research by UCAR and NCAR.

The chairman, as authorized by the October 1960 meeting of the Board, appointed a Planning Committee for the center in January 1961, consisting of W. B. Harrell (chairman), A. R. Kassander, and John C. Calhoun Jr. Their first task would be to select an architect. Houghton suggested that since seven of the member institutions had schools of architecture, the deans of these schools be asked to serve as an ad hoc committee to view the site and advise the Planning Committee on the choice of an architect. A meeting was held on 21 May 1961 by the Planning Committee and the Advisory Committee of Deans (composed of Arthur P. Herrman, University of Washington; Theo. R. Holleman, A&M College of Texas; Burnham Kelly, Cornell University; Sidney W. Little, University of Arizona; Milton S. Osborne, Pennsylvania State University; Philip N. Youtz, University of Michigan; and Pietro Belluschi, MIT) in Boulder to discuss the selection of an architect. The Advisory Committee of Deans selected six architectural firms which they felt would be suitable for the commission. They also formulated a number of points which should be considered in making the final selection of the architect. It was then decided that the director and his staff should undertake the task of interviewing and investigating the six architectural firms and should

then report back to the Planning Committee and the Advisory Committee of Deans.

A second meeting of the Planning Committee and the Advisory Committee of Deans was held in Boulder on 16 July 1961. The director reported that the investigations which he and his staff had made had led them to recommend I. M. Pei and Associates for the commission to site plan and design NCAR. The Advisory Committee of Deans unanimously endorsed this recommendation. [14]

The Executive Committee, on 18 July 1961, approved the recommendations of the Planning Committee on the choice of Pei as architect for NCAR. The director was authorized to seek the concurrence of NSF in this choice and to negotiate a contract with I. M. Pei and Associates. In the latter negotiations the director was to have the assistance of an ad hoc committee consisting of W. B. Harrell, R. Wilkinson, and P. Belluschi.

At the April 1961 meeting of the Board new trustees-at-large were elected: T. F. Malone, to succeed himself, (term: April 1961 - April 1964), J. Churchill Owen, a trustee of HAO, to fill the vacancy left by H. Stommel (term: April 1961 - April 1963), and Detlev W. Bronk [President of the National Academy of Sciences], (term: April 1961 - April 1964).

During 1961 a number of new UCAR committees were created as new problems arose. At the April meetings of the Executive Committee and of the Board the chairman was authorized to appoint a committee to investigate the matter of joint appointments by NCAR and the universities. The Personnel Committee, already in existence, was active throughout the year working with the director's staff to set policies on insurance, salaries, retirement, and other matters of concern.

During consideration of the FY 1963 budget (Executive Committee meeting, 18 July 1961), it was decided that an advisory committee on the budget had become necessary. The FY 1963 budget request was for \$7 million (this figure had already been trimmed down by NSF from \$9 million), which would be crucial for the development of NCAR since

it contained large items for initial construction and the purchase of equipment (a computing facility had already been deleted for that year). The trustees felt that lack of adequate funding in these initial stages could permanently hamper the growth of the center.

In October 1959 the Executive Committee had resolved to hold the membership of UCAR to fourteen institutions and to reexamine the question in two years. The two years having passed by the time of the Executive Committee meeting in December 1961, Chairman Houghton suggested that the matter be considered by the Executive Committee at its April 1962 meeting. The chairman was then authorized to appoint a committee to consider UCAR's admission policy and to study the broader problem of the participation of educational institutions in the activities of UCAR.

The Joint Appointments Committee, composed of M. Neiburger (chairman), W. A. Baum, J. Spar, H. Ridgely Warfield, and V. Hales, was appointed by the chairman in May 1961. They made a report to the Board at its October 1961 meeting. The committee recommended that, in general, the director be allowed maximum discretion in making arrangements until sufficient experience had been gathered to allow formulation of specific rules. The committee believed that the major criterion in considering an appointment should be the overall advancement of the atmospheric sciences. With regard to financial and other considerations, it was felt that the appointment should neither benefit nor penalize the visitor. Short visits by NCAR staff for lectures, etc., might be made at NCAR's expense, at the discretion of the director.

At the October and December Executive Committee meetings the director made further reports on the progress in the planning and operation of NCAR. Four major scientific research areas (already outlined in April) were planned and were partly in operation:

1. Dynamical aspects of the atmosphere.
2. Thermodynamical, physical, and chemical aspects of the atmosphere.

3. Interaction between the atmosphere and underlying ground or ocean surface.
4. Interaction between the terrestrial atmosphere and astrophysical phenomena.

The recruitment of scientific staff was still being carried ahead vigorously (despite some displeasure from some heads of departments in the universities) as well as negotiations with prospective appointees already approved by the Executive Committee. [15] In addition, several visitors were at NCAR for the summer of 1961 from both member and non-member universities and from other institutions. The director termed the program highly effective and said that the first NCAR publications would result from the collaborations of the visitors and the permanent NCAR staff.

It had been pointed out early in the year that NCAR was in need of temporary space in order to get some scientific programs under way before the completion of the permanent laboratory. The first temporary quarters in the University of Colorado Armory were occupied on 5 June 1961 for an expected stay of seven or eight months. Arrangements were made to lease 20,000 square feet of space in the university's physical sciences research building then under construction and due to be completed in early 1962. An additional advantage of this arrangement was that the same building would house the university's new IBM 709 computer.

NCAR had acquired its own IBM 1620 computer in April 1961 which was installed in the HAO building on the University of Colorado campus. The National Bureau of Standards planned to acquire an IBM 7090 in late 1962 and had offered NCAR a share of its use. Fry, with the assistance of W. Lawrence Gates of UCLA, was preparing reports to aid in the planning of NCAR's computing center and to determine the feasibility of its being used as a national facility.

NCAR was already becoming definitely involved with a national balloon facility. The need for such a facility had been brought out at the Conference on Balloon and High Altitude Airplane Flight Facilities called by NCAR in December 1960. In January 1961 the director presented



a suggested plan for the facility to the Executive Committee--NCAR would have a balloon engineering group to give expert advice and assistance to the users, but the actual facilities would be run by a private company with NCAR overseeing operations. Further, an informal panel of users would be formed to advise the director.

By May Lally had been engaged to head the balloon engineering group. The first meeting of the NCAR Panel on Scientific Use of Balloons was held in October 1961, at which time Verner E. Suomi (University of Wisconsin) was elected chairman of the panel. A meeting of balloon manufacturers was held in November to acquaint them with the program. The investigation of sites for a balloon launch facility was begun in the fall of 1961. Throughout this period Lally had also been closely concerned with presenting NCAR's position to the FAA on proposed new regulations for unmanned balloon flights.

Other proposed facilities were in a less advanced stage of planning at the end of 1961. Ivan S. Groodin, recently retired head of the meteorological section of the library of the Commonwealth Scientific and Industrial Organization of Australia, was hired to assist in planning, acquiring, and organizing the NCAR library. The librarians of the National Bureau of Standards and of the University of Colorado had shown considerable interest in developing a cooperative library program for the Boulder scientific community.

Before any plans for a flight facility could be formulated, a survey would be taken by the NCAR staff to determine the universities' needs for instrumented aircraft for atmospheric research over the next several years. This survey and NCAR's needs should indicate the kind of aircraft facilities required and NCAR's role in providing them. The U.S. Weather Bureau had informally enquired whether NCAR and the universities would make use of its Research Flight Facility if this facility were expanded.

A conference was held by NCAR in July 1961 on the state of meteorological rocketry. The facts which emerged from the conference were that such rocketry programs were conducted on a very uncoordinated basis and

that there was very little communication between the data collectors and those researchers who might make best use of the data. A second conference was planned, this time involving those scientists who needed the rocket data, to determine the type, format, and distribution of data that would be most valuable to research meteorologists.

A conference on paleoclimatology, which NCAR would cosponsor with the NAS ad hoc Committee on Paleoclimatology, would be held in the summer of 1962. The conference would explore the natural and historical records which would reveal the climate of the northern hemisphere during the eleventh and sixteenth centuries.

In the spring of 1961 the NCAR senior staff began work on a long-term (ten-year) scientific plan for NCAR. The purpose of this plan was to establish a long-range guide for planning the NCAR scientific programs, for participation in the development of national facilities, for staff recruitment, and for overall budget projects. The report (issued in November 1961) defined five goals of NCAR:

1. To mount a comprehensive, cross-disciplinary attack on the fundamental research problems of the atmospheric sciences on a scale commensurate with their global importance.
2. To provide, or arrange for provision of, facilities for the scientific community as a whole whose initial cost and upkeep lie beyond the capacity of individual universities or research groups.
3. To provide sponsorship and assistance for plannings of research efforts and facilities development on a national scale.
4. To broaden opportunities in postdoctoral work through short-term appointments to the NCAR staff, thereby strengthening the national capacity for theoretical and experimental research efforts.
5. To participate in and otherwise encourage the development of new and stronger modes of international cooperation in the atmospheric sciences.

Specifically the NCAR Ten-Year Plan dealt with:

1. Research goals for the atmospheric sciences as a whole, and their relation to human needs on a world scale.
2. Assessment of the difficulty of reaching various research goals, expressed in terms of the probability of reaching them within certain time periods.
3. Definitions of the areas and modes of research that would fall within the mission of NCAR, and of the resources NCAR would need to pursue its mission.
4. Definition of NCAR's responsibility to the community of atmospheric sciences as a whole (international as well as national), and of the resources and methods needed to meet its responsibilities.
5. Physical plans for the NCAR laboratory.

The bulk of the report dealt with points 3 and 4. The four areas of NCAR research already defined (meeting of the Executive Committee, April 1961) were elaborated upon. Relations with the universities were to be characterized by cooperation and interaction, particularly through various types of staff exchanges. In facilities, the balloon facility (already under way) was prominently discussed, but other facilities, such as radar and a flight facility, were covered as well. It was stressed that more information about research needs was required before other national facilities could be effectively planned. [16]

Plans for the merger between HAO and UCAR developed during this year. At the April 1961 Executive Committee and Board meetings Counsel Hart proposed a procedure for the merger in terms of the necessary legal technicalities. First the trustees of HAO would amend their articles of incorporation and bylaws to make these identical with those of UCAR, and they would change the name of the corporation to UCAR (of Colorado). Then the trustees of UCAR (of Delaware) would call a meeting of members to transfer the corporate assets to UCAR (of Colorado) and to dissolve UCAR (of Delaware). NSF approval would be required for the transfer of

the NSF contract. The University of Colorado would be asked to give up its right to nominate members to the HAO Board of Trustees.

Discussion following this proposal brought out the following points in its favor. UCAR's articles of incorporation provided for a successor corporation, while HAO's did not. HAO held contracts from a number of organizations, all of which would have to approve a transfer of funds, while NCAR needed only the approval of NSF. Also, HAO had received gifts, and there was a question of the HAO Board's right to transfer these gifts. Further, HAO had long been tax-exempt, while UCAR had not yet achieved this status. Finally, HAO was a Colorado corporation and it had always been planned that UCAR should reincorporate in the state where the center was located.

Both the Executive Committee and the Board voted to table the matter at that time. The Board moved to have the chairman appoint a committee (authorized by the Executive Committee, 25 April 1960) to work out details of the continuing relationship between UCAR and HAO.

Chairman Houghton appointed the Merger Committee in mid-May. It was composed of himself, as chairman, H. R. Byers, A. R. Kassander, J. L. J. Hart, and R. Wilkinson. When the committee met on 17 July, Hart and Wilkinson stated that after further study, they still considered the plan presented at the April meetings to be the best. This procedure would simply have the effect of having UCAR reincorporate in Colorado, which had been planned all along. The governing boards of the member institutions would not have to approve such a process of reincorporation.

In May President Quigg Newton, of the University of Colorado, had assured Houghton that he would do all in his power to support the development of NCAR. Shortly thereafter the Regents of the University of Colorado voted to authorize Newton to support the merger.

The HAO trustees were favorable to the merger as well. This fact was demonstrated when, after they had appointed John W. Firor as director of HAO in June, they withheld confirmation of the appointment until the UCAR Board had reviewed the matter and expressed an opinion on it. The

UCAR Executive Committee, at its July meeting, noted the appointment with approval and thanked the HAO Board for its graciousness in bringing it to UCAR's attention.

After hearing the report of the Merger Committee, the Executive Committee (also at its July 1961 meeting) directed that the necessary preparations and paperwork, including draft resolutions, be completed for presentation to the October Board meeting so that the Board might consider calling a meeting of members. The purpose of the members meeting would be to transfer the assets of UCAR of Delaware to UCAR of Colorado and to dissolve the Delaware Corporation. A further resolution was passed recommending that the HAO trustees who were not members of the UCAR Board be constituted as an "Advisory Board for the HAO Division of UCAR."

During September the director held talks with NSF officials, including Director Alan T. Waterman. They received the idea of the merger favorably.

At a special meeting on 10 October 1961 the Board passed a resolution deeming it advisable to dissolve the corporation. The Board further called a meeting of members (for 13 December 1961, 9:00 a.m.) to take action on the preceding resolution and to designate a successor to receive the corporate assets and liabilities. At the regular October Board meeting various measures were passed to meet the legal requirements for the impending transfer and dissolution, such as designating the NCAR office at Boulder as the principal office of the corporation outside of Delaware.

The Board of Trustees of HAO met on 17 November 1961 and amended the certificate of incorporation of HAO to change the name to UCAR of Colorado and to conform with the certificate of UCAR of Delaware. Further, they amended the bylaws of HAO to conform with the bylaws of UCAR of Delaware.

The meeting of members of UCAR was duly held on 13 December 1961. UCAR of Colorado was designated to take over all functions and purposes

of UCAR of Delaware and to receive its property and assets. The transfer, subject to all liabilities and contracts of the corporation, was to be made on 31 December 1961. The officers of the corporation were authorized and directed to file the certificate of dissolution with the Secretary of State of Delaware on or about 31 December 1961.

Immediately after the members' meeting the Executive Committee met to pass resolutions authorizing the takeover of the assets and liabilities of UCAR of Delaware. They further adopted all of the actions of UCAR of Delaware except those dealing with dissolution.

It had been decided to make the merger an occasion for formal celebration, not only of the merger itself, but also of the establishment of UCAR in Colorado, the generosity of the state in donating the site, and the establishment of NCAR's scientific research program. A dinner was held on the evening of 12 December, with Malone giving the principal address, "Progress, Purpose, and Potential in the Atmospheric Sciences." Invited guests included officials of the state of Colorado and of the city of Boulder, people from government agencies and departments (NAS, NSF, Weather Bureau, etc.), UCAR and HAO trustees, and NCAR and HAO staff.

NOTES

1. Testimony before the Subcommittee on Independent Offices and General Government Matters of the Senate Appropriations Committee, 5 June 1959 by H. G. Houghton. Houghton Records, Microfilm II.
2. The members of the ad hoc committee were: E. W. Hewson, D. F. Leipper, J. M. Miller, W. A. Baum, T. P. Wright (chairman). Minutes of the meeting of the Executive Committee of UCAR, 20 August 1959, pp. 1-3.
3. Minutes of the meeting of the Executive Committee of UCAR, 20 October 1959, pp. 1-3.
4. Minutes of the meeting of the Executive Committee of UCAR, 20 October 1959, pp. 3-6. Minutes of the meeting of the Board of Trustees of UCAR, 21 October 1959, pp. 7-8.
5. Ibid., pp. 6-8. Ibid., pp. 6-7.
6. Letter from W. O. Roberts to H. G. Houghton, 28 September 1959. Houghton Records, Microfilm II.
7. Letter from J. Van Allen to H. R. Byers, 6 November 1959. Houghton Records, Microfilm II.
8. In taking this action the ad hoc committee and the Nominating Committee went against their own recommendations, approved by the Executive Committee on 20 August 1959, that in the event of Van Allen's refusal of the directorship, the ad hoc committee, with the addition of Kassander and Macaulay, should be reconvened for the purpose of nominating another candidate. This situation generated some displeasure on the part of P. S. Macaulay. Letter from H. G. Houghton to P. S. Macaulay, 9 February 1960; Letter from P. S. Macaulay to H. G. Houghton, 15 February 1960. Houghton Records, Microfilm II.
9. A. R. Kassander fully reported his conversations with W. O. Roberts in a letter to the chairman of the Nominating Committee. Letter from A. R. Kassander to H. R. Byers, 29 February 1960. Houghton Records, Microfilm II.
10. Minutes of the meeting of the Executive Committee of UCAR, 17 March 1960, p. 4.
11. Letter from H. R. Byers to Members of the Executive Committee, 8 April 1960. Houghton Records, Microfilm II.

12. A Report of Site Evaluation Studies and Recommendation of a Site for the Headquarters of the National Center for Atmospheric Research, 4 November 1960, pp. 16-24.
13. Letter from Governor Stephen L. R. McNichols to A. T. Waterman, Director of NSF, 7 October 1960.
14. Progress Report of the Planning Committee, 10 October 1961.
15. Letter from S. L. Hess to P. D. Thompson, 8 May 1961.
16. Outline of a Ten-Year Plan for NCAR, November 1961.







Climax Station of the High Altitude Observatory



## CHAPTER III

THE HIGH ALTITUDE OBSERVATORYA. The Fremont Pass Station of the Harvard College Observatory

This branch of the Harvard College Observatory informally opened on 8 September 1940 at Climax, Colorado (elevation 11,520 ft.). Its sole purpose was to study the sun, using the first coronagraph in the western hemisphere. The coronagraph, developed by Bernard Lyot in 1930, provides an artificial eclipse of the sun by means of an occulting disc within the instrument. The success of the observations depends on minimizing the diffused light which obscures the corona. Light is scattered both in the atmosphere and in the optical elements of the telescope. The latter problem can be solved by design and by precision in the manufacture of the instrument. Atmospheric diffusion, however, can only be overcome (on earth) by going to very high altitudes where the air is rarefied and pure; hence the choice of Climax.

In the 1930s Donald H. Menzel, of the Harvard College Observatory, had visited Lyot in France. After seeing the results which Lyot had obtained with his coronagraph, Menzel determined to construct one himself. At Harvard, Menzel and Hobart W. French Jr. worked on the design and construction of a Lyot-type coronagraph with a 5-inch objective. When Walter Orr Roberts came to Harvard as a graduate student in astronomy in early 1939, he joined the project.

The site at Climax was chosen by Menzel in the summer of 1939. The coronagraph was brought out by Roberts in the following summer and was installed in the fall of 1940. During the rest of that year and the next, the instrument had only a 3-inch lens. A spectrograph and a motion picture camera served as auxiliary equipment for the coronagraph. James G. Baker, of Harvard, produced a 5-inch lens of the necessary optical quality in early 1942. The first two years were largely devoted to improving the quality of observations and working out instrumental problems, rather than to a regular research program.

From coronagraphic studies which he had made in the 1930s, Max Waldmeier of Switzerland had tentatively concluded that the intensity of the coronal green line correlated with terrestrial magnetic activity. This correlation could lead to the prediction of communications disturbances. [1] Roberts, now at Climax as the superintendent and sole observer, and John Howard Dellinger, of the Carnegie Institution of Washington, simultaneously concluded that changes in the corona were in fact related to changes in the earth's ionosphere, which did affect radio and other long-range communications. The fact that the appearance of the corona gave added lead time to the prediction of radio communications disturbances, and the fact that World War II was then in progress meant that the work of the observatory was classified for the duration.

The wartime work of the observatory was done under the auspices of the Navy, although overall direction remained in the hands of Harvard. Every day coded reports on the condition of the corona were telegraphed to the Carnegie Institution in Washington, D.C. for the preparation of predictions of communications conditions. During the last year and a half of the war the Navy provided an assistant for the observatory, Lt. Lewis Larmore. Apart from this period, Roberts remained the only observer at Climax, although a few local technical assistants were hired on a part-time basis.

At the end of the war the National Bureau of Standards contracted with the observatory for regular reports on solar activity. By 1945 Harvard had decided that the observatory should be set up as a separate corporation, rather than being run by the Harvard College Observatory as an out-of-state business. The University of Colorado and Denver University were approached about jointly sponsoring the venture with Harvard. Denver University could not participate, but President Robert L. Stearns of the University of Colorado was enthusiastic about the prospect. The corporation was to have six trustees, three of whom were to be appointed by each university. The incorporation meeting was held on 12 April 1946 in Denver, Colorado.

B. High Altitude Observatory of Harvard University and University of Colorado

The original incorporators of the High Altitude Observatory of Harvard University and University of Colorado were Peter H. Holme, E. Ray Campbell, and J. Churchill Owen. The active members of the corporation were to be six trustees, three to be nominated by the president of Harvard University and three to be nominated by the president of the University of Colorado. [2] The members named to the first Board of Trustees were, for Harvard:

William S. Jackson, Justice of the Supreme Court of Colorado  
 Peter H. Holme, Attorney of the law firm of Dines, Dines,  
 & Holme of Denver, Colorado  
 William C. Sterne, Director and Past President of the Public  
 Service Company of Colorado

for the University of Colorado:

E. Ray Campbell, Editor and Publisher of the Denver Post  
 Erskine R. Myer, Attorney of the law firm of Brock, Akolt,  
 Campbell & Myer of Denver, Colorado  
 Earl L. Mosley, City Manager, Colorado Springs, Colorado

The bylaws specified that the corporation should have a president and a vice-president, both of whom were to be members of the corporation. The other corporate officers were to be a secretary and a treasurer, not necessarily members of the corporation. All officers were to be elected by the Board of Trustees.

At the first meeting of the Board of Trustees, 6 May 1946, the following corporate officers were elected:

President: P. H. Holme  
 Vice-President: E. R. Campbell  
 Secretary: J. C. Owen  
 Treasurer: D. W. Bray

At this first meeting a letter from Harlow Shapley of Harvard was read which outlined the scope of the work of the corporation and suggested the creation of a committee on scientific operations. This committee would plan the program of the corporation's operations and carry it out under the supervision of and with the assistance of the

Board. The president appointed H. Shapley, D. H. Menzel, and W. O. Roberts to the Committee on Scientific Operations after the Board had moved its creation.

In addition to directing the normal operations of the observatory and coordinating its work with that of other institutions, the committee was given the responsibility for the planning and building of the new observatory. In 1942 Roberts had pointed out the necessity of moving the site of the observatory farther from the dust and smoke of the Climax molybdenum mine. [3] The equipment of the new observatory was also to be considerably expanded. Plans formulated by mid-1946 called for a triple telescope which would contain a coronagraph with an aperture of 10 to 15 inches, a solar telescope with an aperture of 15 to 20 inches, and a 15-inch reflecting ultraviolet telescope. The 6-inch coronagraph then in use would be retained as a patrol instrument.

The research purposes of this equipment, set out by Roberts in his report to the HAO Board of Trustees in November 1946, would be to: (1) investigate variations in sunspots, (2) study the fluctuating brightness of the solar corona, (3) study the prominences, and (4) study activity on the solar surface. It was also anticipated that the observations made at Climax would be of great value to the studies of ultraviolet radiation, cosmic rays, and the variations of the earth's magnetic field being undertaken by other organizations and individuals. [4]

The Central Radio Propagation Laboratory (CRPL) of the National Bureau of Standards was funding the operational costs of HAO. CRPL was still interested in receiving regular solar reports, as it had done during the war, as part of its overall ionospheric program. Funds for the new instruments were coming from the Office of Naval Research, the Army Air Force, and the Research Corporation as well. Further, the U.S. Weather Bureau had expressed an interest in the work at Climax in the belief that it would contribute to the solution of the problem of long-range weather prediction.

While funds from the above sources seemed to assure the construction of the instruments for the new observatory, a problem remained in obtaining the funds for the actual construction of the buildings to house the equipment. All of the funds which had been obtained from both government agencies and private foundations had so far specifically excluded their use for construction. The estimated need for the buildings was \$250,000, which Menzel felt would have to be raised in Colorado. [5]

The personnel and operations of the observatory were also expanded at this time. John W. Evans joined HAO as research associate in the spring of 1946. Roberts had planned to move the headquarters of HAO down to Boulder, but first spent a year at Harvard in teaching and research. In 1947 both Evans and Roberts were established in Boulder, with an observer handling the work at Climax.

By mid-1947 the Army Air Force (AAF) had decided to set up its own solar research facility somewhere in the vicinity of Alamogordo, New Mexico. The AAF people had already held preliminary discussions with Menzel about the possibility of HAO directing this work. In July of 1947 Menzel, Roberts, and Evans surveyed the area near Alamogordo, and chose Sacramento Peak as a promising site. HAO then accepted a contract with the AAF for a detailed site survey. Two observers were encamped on Sac Peak to make more thorough site tests. The results of these tests confirmed HAO's original selection of the site. The recommendation of Sac Peak as the site for the solar observatory was made to, and approved by, the Research and Development Board of the Department of Defense in April 1948.

The Air Materiel Command then signed a contract with Harvard for the development and construction of equipment for the Sacramento Peak Observatory (SPO). HAO would have no formal responsibility for this contract, but its work would be closely coordinated with that of SPO, and some of the same personnel would be involved. Plans were then formed to house the development center for SPO, with the laboratory and administrative center for HAO on the University of Colorado campus.



During 1947 HAO had been given a 10½-inch refractor from the Bausch and Lomb Observatory of Rochester, New York. HAO wished to have this instrument set up at Boulder for student use and public demonstration as well as research. By early 1949 the Regents of the University of Colorado (CU) had agreed to make funds available for the construction of a new observatory on campus to house this telescope. The building was to be called the "Sommers Memorial Observatory" in honor of the person from whose estate the funds had come. It was planned that the HAO building would be constructed nearby, although funds were not yet available.

Funds for construction of the new buildings at Climax were also not yet available by 1949. Climax Molybdenum Company had delivered a quitclaim deed for the new site to HAO in late 1946. Construction of two Quonset huts and two prefabricated houses for observers at the new site was approved in July 1949 by the HAO Board. This construction would use up all of the unrestricted funds. The estimate of the cost of the dome for the coronagraph, at that time, was \$75,000. However, by the summer of 1950 this estimate had risen to \$160,000, based on the cost of a similar building at SPO.

The development of the large coronagraph itself had been proceeding slowly. In 1947 a contract was signed with Perkin-Elmer for the engineering design, with funds provided by the Office of Naval Research. When this design work was completed in the next year a contract between ONR and HAO provided funds for the construction of the coronagraph. In May 1950 Westinghouse Electric Company was approved as the sub-contractor for the construction of the coronagraph. At the same time, the ONR extended its contract for the completion of the coronagraph and added more funds, bringing the total to \$154,000.

During 1949-1951 there were several changes in the Board of Trustees. In February 1949 Thomas B. Knowles was elected a trustee to fill the vacancy left by the death of Sterne. During the following year the number of trustees was increased from six to eight, with the additional members to represent the administrative departments of Harvard and the

University of Colorado. Paul H. Buck, provost of Harvard, and Robert L. Stearns, president of CU, were then elected to the Board. [6] In the spring of 1951 Holme resigned as a Trustee and Jackson was named acting president of the Board.

In November 1950 the Committee on Scientific Operations (CSO) also underwent some structural changes. The proposals for the reorganization of the CSO grew out of an earlier meeting attended by Buck, Stearns, Jackson, Mosley, and Knowles. As Provost Buck explained then, the purposes of the new CSO would be to enlist people not directly connected with HAO but with definite professional interest in its work, and to make the CSO a policy-making body rather than administrative. The old CSO was then discharged and a new Committee on Scientific Operations was created with the following members:

Donald H. Menzel, Harvard (ex officio)  
 Harlow Shapley, Harvard (ex officio)  
 Fred L. Whipple, Harvard  
 Leo Goldberg, University of Michigan  
 Edward U. Condon, Bureau of Standards  
 James Broxon, University of Colorado  
 Byron Cohn, University of Denver  
 Captain Paul Hammond, New York City  
 James H. Smith Jr., Aspen

Also: Person at Harvard College Observatory responsible for the Solar Research Program (ex officio and chairman)  
 Director of the Harvard College Observatory (ex officio)  
 Head of Astronomy Department of the University of Colorado (ex officio)

The size of the observatory staff had increased considerably since 1946. By 1951 there were 37 people employed by HAO, including two observers at Climax. The rest were at Boulder, located in space leased from the University of Colorado. Research was still focused on the physics of the sun. Observations of the solar corona and surface features were an important part of the program, but much theoretical work was being carried on as well in such areas as deviations from thermodynamic equilibrium and energy transport in the solar atmosphere. Another principal field of research at HAO was that of solar-terrestrial studies. Besides the relation between solar outbursts and the earth's

ionosphere (with its effect on radio communication), there were also the meteorological consequences of the solar heating of the upper atmosphere to be studied.

Funds for supporting the work of the observatory were in short supply during this period. Some relief was provided, however, when in 1951 HAO signed a contract with ONR to participate in an expedition to Khartoum, Sudan, to observe the solar eclipse of 25 February 1952. The initial contract provided \$25,000 for research and the construction of equipment, with \$15-35,000 in additional funds to be supplied to complete the project. The equipment had to be completed and delivered for transshipment (by the Navy) by 1 November 1951. The expedition team (J. W. Evans, Robert H. Cooper, and Robert H. Lee) left Boulder in January 1952 and flew to Khartoum, carrying some of the more delicate equipment with them. Observing conditions were good and a number of spectrograms of excellent quality were obtained. The success of the observations was all the more remarkable in view of the fact that Evans, who was in charge of the optical alignments, fractured his leg ten days before the eclipse, which greatly increased the difficulty of making the final instrumental adjustments. [8]

The reduction and analysis of the eclipse data continued over the next several years. The ONR contract was extended for this work, which included the construction of an electronic microphotometer. This project was finally completed in 1961 with the publication of a monograph by R. Grant Athay and Richard N. Thomas, combining a description of the eclipse observations and the theoretical results derived from them. Several Ph.D. theses and a number of research reports had also resulted from the Khartoum eclipse data.

While the eclipse contract with ONR partially relieved the problem of operating funds for HAO, no progress had been made in obtaining construction funds for the large coronagraph dome at Climax. Concern had been expressed that ONR would decide to locate the coronagraph elsewhere, where the Navy itself could provide the buildings, if HAO was not able to raise the necessary funds. In July 1951 talks were held

with Condon of the National Bureau of Standards (NBS) about the possibility of NBS taking over the operation of HAO and constructing the dome for the coronagraph. Since NBS was not enthusiastic about the prospect, and since HAO would not have been allowed to remain as a separate entity within NBS, nothing came of this idea. Roberts then began to organize a fund-raising campaign with the assistance of Robert J. Low (executive officer of HAO since September 1951). By the end of 1952 \$75,000 had been raised (\$50,000 in one grant from the James Foundation). During this year the 26-foot spar for the coronagraph had been completed and shipped to Climax to be stored until its building was ready. The building fund goal of \$149,000 was reached by the end of June 1953, and construction was under way at Climax by the fall of the year. [9]

The Sommers Observatory, constructed on the CU campus to house the 10½-inch telescope from the Bausch and Lomb Observatory, was completed in late 1951. The formal dedication was held on 27 August 1953 to coincide with the meeting of the American Astronomical Society being held in Boulder at that time. Subsequently the observatory became known as the Sommers-Bausch Observatory.

Part of the HAO staff moved into the new campus observatory as soon as it was ready for occupancy. Thus by the summer of 1952 the staff were housed in the observatory, a temporary building on the campus, and the Western Cutlery Company building at Broadway and Marine in Boulder. The major change which the staff underwent at this time was the departure of Evans to supervise the Air Force project at SPO. Also in the summer of 1952 Roberts' title was changed from supervisor to director of HAO.

Jackson was elected president of the Board of Trustees in August 1952. At the same meeting Hart (proposed by President Conant of Harvard) was elected a trustee to fill the vacancy left by the resignation of Holme. At the end of the year Bray resigned as treasurer and Edward C. King (treasurer of CU) was elected treasurer of HAO. In the fall of 1953 President Pusey of Harvard designated McGeorge Bundy to replace

Buck as Harvard's administrative representative on the Board of Trustees. Ward Darley, the new president of CU, was elected to replace Stearns on the Board at the same meeting.

The dedication of the new solar laboratory and coronagraph at Climax took place on 9 September 1954. The 26-foot equatorial table was in place but was still without the actual optics of the coronagraph. The other facilities of HAO at Climax had been completely moved by 1952 to the new Chalk Mountain site (about 3 miles from the original site).

A major change in the management structure of HAO occurred in 1954 when Harvard withdrew from sponsorship of the observatory. A number of factors were involved in this move; among these was the fact that Harvard felt it would not be able to give further aid to HAO in meeting its financial needs, and there had also been a change in administration at Harvard which had resulted in the university closing out many of its off-campus activities. There were also some problems between the Committee on Scientific Operations and the administration of the observatory, which had begun almost with the beginning of the new CSO in 1950. In the summer of 1953 the CSO asked the Board of Trustees of HAO to define its function more clearly. Menzel felt that the staff of HAO was not making adequate use of the CSO and, in particular, that research proposals from HAO should be circulated to the CSO for approval before they were submitted to government agencies. [10] Roberts, on the other hand, felt that the CSO was too involved in the direct administration of HAO (e.g., concerning itself with hiring and firing) and that it was, in any case, a weak administrative body since it was geographically dispersed and it never met at Climax or even Boulder. Further, Roberts contended that since most of the CSO members could not attend every meeting (they met at Cambridge), Menzel made all of the committee's decisions in practice. [11]

In March 1954 Darley wrote to Bundy suggesting that the time had come to make HAO the sole responsibility of the University of Colorado (the CU Regents had already approved such a move). Bundy replied in May that both Pusey and the Harvard College Observatory Council had

agreed that it would be best for Harvard to withdraw from formal responsibility for HAO. Later in the summer of 1954 Darley (acting at the behest of the HAO trustees, particularly the Harvard appointees) again sought ways in which the joint sponsorship of HAO might be continued. Harvard's decision to withdraw was final, however, and Darley was authorized by the Regents to negotiate the dissolution of the earlier arrangements and to proceed with plans to set up HAO as the sole responsibility of CU.

The original plan for the transfer of the responsibility for HAO to CU had called for the Regents to replace the Board of Trustees and for the director of HAO to report directly to the president of CU. However, it was found that this course would involve grave legal difficulties in the process of turning over donated funds and properties to another corporation. The Regents then approved a plan to keep the original corporation and have the bylaws changed to provide for the filling of vacancies on the Board by nomination of the president of CU and approval of the Regents. The Board wished to change the name of the observatory to the Colorado High Altitude Observatory, but the Regents insisted that the university be retained in the title.

C. High Altitude Observatory of the University of Colorado

On 17 February 1955 the Board of Trustees of HAO met to amend the certificate of incorporation and the bylaws of the corporation. The amendment to the certificate of incorporation provided for the change of name of the observatory and made the number of trustees variable (not less than five, not more than fifteen--the exact number to be set by the bylaws). The bylaws were then changed to set the number of trustees at eight and to provide that a vacancy on the Board should be filled by a nomination by the president of CU with the approval of the Regents. At this meeting consideration was also given to the formation of an executive committee and a scientific advisory committee.

In July 1955 the Board approved the creation of a board of advisors consisting of six or more members appointed by the trustees and one appointed by the president of CU. The Board would primarily help with

fund raising and in obtaining government contracts rather than with scientific or administrative advice. Roberts also advised having a different outstanding scientist come for one or two weeks each year to examine the work of HAO and make a report to the Board of Trustees.

The Executive Committee was created at the end of 1955. It was to be a standing committee consisting of the president, vice-president, the secretary, and the president of CU or his representative. This committee would have the powers of the Board between the meetings of the Board, but it could not change existing policies or establish new ones.

In January 1956 an Institute of Solar-Terrestrial Relations was launched by HAO. Planning and fund raising for the institute had started several years earlier. Funds were sought from airlines, oil companies, and others who had a direct interest in the accurate prediction of weather and climate. The institute was set up for a four-year period. Its principal aim was to study the effects of the sun on weather with the hope that from this work would come an improvement in weather or climate forecasting based on analysis of variations in the emissions from the sun. Besides the work undertaken at HAO, the institute would attempt to stimulate other groups to follow given directions of research and analysis at their own laboratories. [12]

The first year's work of the institute included study of the solar K-corona by the HAO staff (a K-coronameter was completed and installed in 1956) and the sponsorship of a six-week Solar-Weather Seminar. The seminar, which drew 25 participants from across the country, included both formal sessions and informal discussions. The American Meteorological Society cosponsored the seminar and part of the expenses were met by a grant from NSF.

Preparations were also under way in 1956 for HAO's participation in the International Geophysical Year (1 July 1957 to 31 December 1958). The proposal was made and accepted that the IGY should set up its World Data Center for solar activity at HAO in Boulder. The data center would be housed in a new building on the CU campus, a move which would

also serve to bring all of HAO's Boulder activities together under one roof. A fund-raising campaign for the building was launched in the summer of 1956.

In the fall of 1956 the Regents of CU approved the creation of a Department of Astro-Geophysics in the graduate school of CU. It was proposed that Roberts would be head of the department and professor of astro-geophysics, and that Athay and James W. Warwick would be appointed lecturers in the department. Approval of this proposal by the HAO Board was followed by a discussion of the relationship between HAO and CU. It was felt that HAO should remain a separate legal entity and that some sort of contractual arrangement should be worked out with CU.

The HAO Board had undergone some changes of personnel in recent years. Bundy resigned from the Board in 1955, when Harvard severed its formal relations with HAO, and later in the year Darley nominated Owen to replace him. In December of 1956 Stearns, former president of CU, was elected as trustee to fill the vacancy left by the death of Myer. At the same meeting Darley tendered his resignation since he was leaving the presidency of the university. His successor as president of CU, Quigg Newton, was elected to replace him.

HAO's first scientific visitor was Leo Goldberg (director of the McMath-Hulbert Observatory, University of Michigan) who came in August 1956 to review the work and scientific program of the observatory. Goldberg's report on HAO was very favorable and the trustees were pleased with their meeting with him. They decided that the institution of an annual scientific visitor eliminated the need for electing a trustee with a scientific background. [13]

Another move to involve people outside of the observatory more closely with the work of HAO was the appointment of honorary research associates. The first such appointments, made in 1955, were R. N. Thomas, J. H. Rush, and Jean-Claude Pecker. The following year Captain Mary Converse and Sadami Matsushita were named research associates of HAO. Every year thereafter several new associates were appointed and



some of the old ones renewed. Usually these people had been directly associated with or had made some outstanding contribution to HAO.

In the summer of 1956 the financial position of HAO appeared to be quite sound. An eclipse expedition to the South Pacific for the October 1958 eclipse, under the sponsorship of the Air Force, was being planned. [14] But in the early fall of 1957 unofficial word came (first from Evans of SPO) that the Air Force was planning to sharply curtail its expenditures in the field of research. This move would have affected not only the HAO programs (both the eclipse expedition and the general solar research program) but research programs for the IGY and at universities around the country. The Board of Trustees, in early October, decided to continue the work on the eclipse expedition equipment in the hope that the Air Force funds would be continued. In fact, the Air Force had promised to continue its support by the end of that month, although the funding was delayed by technical difficulties. The decision of the Air Force to continue its research support was undoubtedly influenced both by the widespread protest in the scientific community and by the appearance of Sputnik I on 4 October 1957.

The quest for funds for capital building projects continued--both for the Boulder research center (to house the IGY World Data Center, the Boulder section of HAO, and the teaching facilities of the Department of Astro-Geophysics) and for observer housing at Climax. The large coronagraph also required funds for its completion; NSF granted \$80,000 for the construction of a spectrograph for the 16-foot equatorial table in late 1958. The necessary funds for the research center were pledged by the spring of 1959. Most of the contributions were from foundations--the Max C. Fleischmann Foundation of Nevada being the largest contributor. The observer residence at Climax was finally built with a low-interest loan from CU.

In the late 1950s HAO was deeply involved in the activities of the IGY. Besides doing the solar patrol work of a regular IGY reporting station (photographing the sun every few minutes), HAO also served as a World Solar Data Center. Coded data on the sun poured in daily from

all over the world, and plans had to be formulated for the analysis and comparison of this mass of rapidly accumulating material.

Other programs were being carried on as well. A pioneering sweep-frequency radio telescope, located north of Boulder, went into operation in the fall of 1957. The telescope and equipment added later were used both for the direct study of the radio sun and for the study of the effect of solar flares on the earth's ionosphere.

Two eclipse expeditions were planned and carried out in this period. The first was to the South Pacific for the October 1958 eclipse and the second was to the Canary Islands in October 1959. Unfortunately the weather did not cooperate on either occasion and no data were obtained.

A program to study the aurora of Venus and the atmospheres of the planets led into the use of high-altitude balloons. The first pilot experiment flight took place in August 1959. The following year two unmanned flights carried equipment to heights of 80,000 feet to determine sky brightness and polarization near the sun. Further flights were planned for the 1960s using smaller balloons.

The Institute for Solar-Terrestrial Research completed its four years of existence at the end of 1959. Several activities were planned with the funds remaining from the institute. First was further study of the relationship between an increase in the number of solar-charged particles and the amplification of low-pressure troughs near the 300-mb level of the atmosphere. A second follow-up project was the Conference on Solar Weather Relationships, jointly sponsored by the Institute for Solar-Terrestrial Relations, the Geophysical Institute of the University of California, and the American Geophysical Union, held in April 1960 at Lake Arrowhead, California. The research programs of the institute were to be continued, but new sponsors were to be sought.

The Department of Astro-Geophysics began instruction of its first students in the fall of 1957. The department offered only graduate courses, which were taught by staff members of HAO and the National Bureau of Standards. By the following year it was necessary to appoint a staff member as assistant director of HAO for astro-geophysics. The

first assistant director, who was de facto head of the department, was J. W. Warwick. In June 1960 Donald E. Billings took over the Department of Astro-Geophysics and later in the year was appointed head of the department by the university. By that time there were some 20 graduate students in the department, and several had already received their Ph.D.s.

By 1960 the Department of Astro-Geophysics and the Boulder section of HAO finally had a place of their own with the completion and dedication of the High Altitude Observatory and Astro-Geophysics Building of the University of Colorado (8 October 1960). The building funds (\$280,000) had largely been raised through private contributions. CU provided about one-fourth of the funds since part of the building was to be used for their astro-geophysics department. Title to the building remained vested in CU, but HAO was assured of use of the building for an unspecified number of years. [15]

In May 1958 Roberts reported to the HAO Board that the establishment of a National Institute for Atmospheric Research had been recommended by a distinguished scientific committee. He further discussed the possibility that such an institute might be located in Colorado and that HAO might well wish to affiliate with it. The following year Roberts was elected a trustee-at-large of the University Corporation for Atmospheric Research--the organization which was planning and would operate the institute. (See Chapter II.)

The position of director of the National Center for Atmospheric Research was offered to Roberts in May 1960. He reported to the HAO Board that he had urged upon UCAR the location of the center at Boulder and the merger of HAO with the new center (as a separate division), and that if this were done, the post would be highly attractive to him. The merger would mean a loosening of the ties between HAO and CU. President Newton had discussed this aspect with the Regents and reported that they regretted the loss to CU but felt that the gain to the state of Colorado would outweigh it; hence they were favorable to the proposed merger. Roberts confirmed that the HAO Board would go out

of existence when a merger with UCAR occurred, but that some of the HAO trustees might go onto the UCAR Board or that the HAO Board might be kept in an advisory capacity. Roberts wished to remain as director of HAO while the merger was being negotiated and suggested that Athay be made associate or assistant director. [16]

While some of the HAO staff\* expressed concern over the possible submergence of the astronomical aspects of HAO in a merger, most were reassured by the idea of HAO as a separate division and felt that the advantages would outweigh the disadvantages. A merger plan was suggested (and finally adopted, see Chapter II) in March 1961 whereby HAO would change its articles of incorporation and bylaws to make them identical with those of UCAR, and would change its name to UCAR. The new UCAR would be a Colorado corporation; the old UCAR (of Delaware) would then be dissolved and its assets transferred to the new UCAR. [17]

To facilitate communication regarding the merger, Jackson was elected to the UCAR Board of Trustees. Later, in March 1961, the HAO Board amended the bylaws to expand the number of trustees to ten and elected Byers and Kassander (members of the UCAR Board) as HAO trustees. The HAO Board appointed Firor as associate director of HAO in June 1961, with the provision that the action be submitted to the Executive Committee of UCAR for their reaction. [18]

On 17 November 1961 a meeting of members of the High Altitude Observatory of the University of Colorado amended the articles of incorporation of the corporation by substituting for the original articles the articles of incorporation of the University Corporation for Atmospheric Research, modified slightly to be a Colorado corporation. A meeting of the HAO Board of Trustees immediately followed which amended the bylaws to make them coincide with UCAR's bylaws. The Board then set up an advisory board for HAO consisting of Campbell, Knowles, Mosley, Newton, and Stearns.

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\*At this time the HAO staff consisted of some 14 Ph.D. scientists in a total of 58 people.

The final step in the merger was taken when the meeting of members of UCAR, held in December 1961, designated UCAR of Colorado to take over all of the functions and purposes, liabilities and assets of UCAR of Delaware (see Chapter II).

NOTES

1. W. O. Roberts. Preliminary Studies of the Solar Corona and Prominences with the Harvard Coronagraph. Thesis, Harvard University, 1943, p. 11.
2. Bylaws of the High Altitude Observatory of Harvard University and University of Colorado.
3. Roberts. op. cit., p. 91.
4. Appendix B, Minutes of the meeting of the Board of Trustees of HAO, 17 November 1946.
5. Minutes of the meeting of the Board of Trustees of HAO, 5 March 1947.
6. Minutes of the meeting of the Board of Trustees of HAO, 17 November 1950, pp. 2-3.
7. Ibid., pp. 3-5.
8. Status Report No. 3 (1 January 1952 through 31 March 1952), ONR Contract Nonr-393(01), p. 1.
9. A complete list of donors to the Solar Laboratory at Climax, Colorado follows:

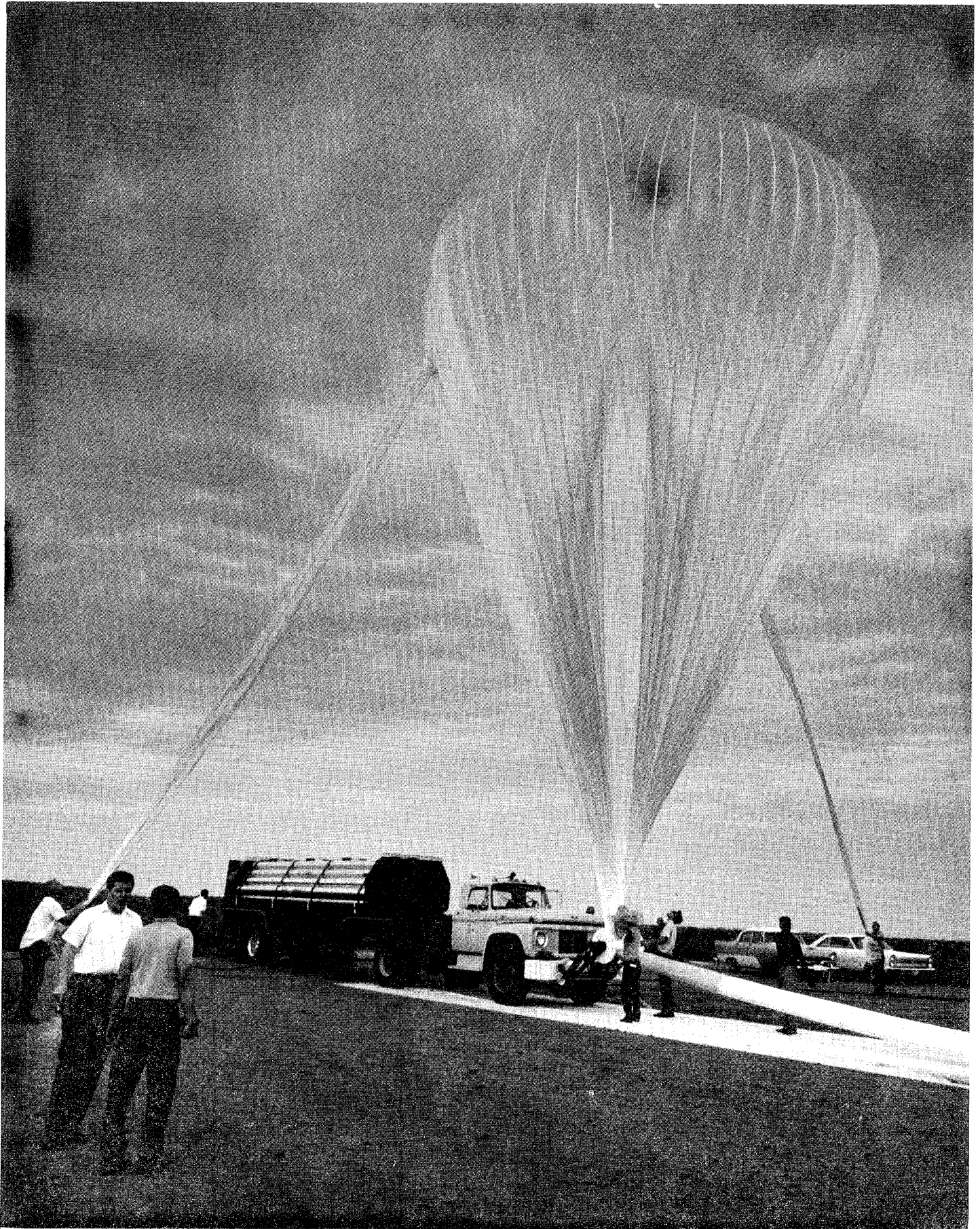
American Crystal Sugar Company	James Foundation of New York
Vincent Astor	Jesse H. Jones
The Barth Foundation	David O'D. Kennedy
Boettcher Foundation	Thomas B. Knowles
James L. Breese	The Lawrence Phipps Foundation
E. Ray Campbell	Mr. & Mrs. Carl M. Loeb Jr.
Hamilton M. Chase	The Loomis Institute for Scientific Research
Climax Molybdenum Company	Carl A. Norgren Foundation
The Colorado Fuel and Iron Corporation	Walter S. Orr
The Columbia Gas System, Inc.	The Perkin-Elmer Corporation
Consolidated Vultee Aircraft Corporation	Max Schott
Adolph Coors Company	Henry Sears
E. DeGolyer	Alfred P. Sloan Foundation, Inc.
The Denver Union Stockyard Company	Texas Instruments, Inc., and Geophysical Service, Inc.
Farr Farms Foundation	Mahlon D. Thatcher
The Great Western Sugar Company	Charles S. Sterne
Paul Hammond	The Van Hummell-Howard Foundation
William S. Jackson, Helen Jackson, Edith B. Jackson	Ella Mullun Weckbaugh
	Thomas Watson Jr.

10. Memo to files (Miscellaneous Confidential), W. O. Roberts, 27 February 1952.
11. Memo to files (Miscellaneous Confidential), R. J. Low, 17 September 1953.
12. The Director's Quarterly Report 1955-4, 1 September 1955 - 31 December 1955, High Altitude Observatory, p. 3.
13. Minutes of the meeting of the Board of Trustees of HAO, 4 December 1956, p. 6.

Reviewers of subsequent years were as follows:

1957	M. G. J. Minnaert	Utrecht Observatory
1958	J. Greenstein	California Institute of Technology
1959	J. Van Allen	University of Iowa
1960	S. Chandrasekhar	Yerkes Observatory
1961	J.-C. Pecker	Paris Observatory
1962	G. Munch	California Institute of Technology

14. Annual Financial Report of the High Altitude Observatory of the University of Colorado, 3 December 1956.
15. Minutes of the meeting of the Board of Trustees of HAO, 6 May 1960, pp. 5-6.
16. Ibid., pp. 1-6.
17. Minutes of the meeting of the Board of Trustees of HAO, 20 March 1961.
18. Minutes of the meeting of the Board of Trustees of HAO, 27 June 1961.





Launching of Coronascope II from the Palestine,  
Texas station of NCAR's Balloon Facility, 1965

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## CHAPTER IV

THE EXPANSION OF THE UNIVERSITY CORPORATION  
FOR ATMOSPHERIC RESEARCH

The chairman of the Board of UCAR had been authorized at the December 1961 Executive Committee meeting to appoint a committee to consider UCAR's admission policy. This committee, which consisted of G. S. Benton (chairman), W. A. Baum, G. L. Lee Jr., T. F. Malone, and Joseph L. McCarthy, was called the Committee on Participation in UCAR. The first of many reports of this committee was made to the June 1962 meeting of the Executive Committee.

The committee reported that there were, at that time, some 20 to 25 institutions with an interest in the atmospheric sciences. There was a definite feeling of a need for broadening the educational membership of UCAR. The problem lay in how to accomplish this without interfering with the effectiveness of management. The committee suggested that either the number of representatives of each institution might be reduced or that the representatives might form a council which would elect a board of trustees to perform the management function.

Houghton warned that management needed a group of people with deep feeling about it. A sort of rotating representation on the Board might mean that the institutions would not feel a sense of continuing responsibility. He went on to suggest that participation could be enlarged through associate memberships with a council of associate members electing trustees-at-large to the Board. The participation committee was asked to further pursue its considerations. The chairman appointed Director Roberts to the committee. [1]

While 1962 marked the beginning of UCAR's considerations of expanded membership, it also marked the end of the first three years of UCAR's corporate existence and the expiration of the terms of the corporation's officers. At the April 1962 Board meeting the following officers were elected:

Chairman: H. R. Byers  
 Vice-Chairman: A. R. Kassander  
 Secretary-Treasurer: M. A. Farrell  
 Assistant Secretary and Assistant Treasurer: R. J. Low

Other elections were:

Trustee-at-Large (three-year term): Q. Newton  
 Executive Committee (three-year terms): W. A. Baum,  
 P. E. Church, H. G. Houghton  
 Nominating Committee: G. L. Lee Jr. (chairman),  
 S. L. Hess, George A. Pettitt

The development of NCAR's facilities was another area of attention in early 1962. A report containing recommendations on computer systems for NCAR, prepared by Fry and Wiin-Nielsen with Sidney Fernbach of Lawrence Radiation Laboratory, was presented to the Executive Committee in April 1962. It had already been decided that NCAR would need a larger and faster computer than any available at that time and that it should be available by 1965. Only Control Data Corporation was found to have had a model distinctly different from the rest. Using standard components in a new design, this model would accomplish a great speedup with little increase in cost. It would be about five times faster than the IBM STRETCH, at two-thirds the cost, and ten times faster than the Remington Rand LARC at about an equal price. The report recommended the Control Data 6600 computer for NCAR at a price of \$6.75 million.

The second or third Control Data 6600 system produced would probably be ready when the laboratory on Table Mountain was ready. Control Data would probably not agree to a lease agreement but would want a firm order. It was pointed out that the lump sum of \$7 or \$8 million would be difficult to handle in any one contract year.

The Executive Committee reaffirmed its thinking that NCAR needed a large computer of advanced design. The director was authorized to proceed with deliberate speed to carry out the recommendations of the computer report. It further directed that negotiations were to be undertaken with Control Data by the staff, legal counsel, NSF, and a small committee, to be appointed by the chairman of the Executive

Committee. The subsequently appointed Computer Committee consisted of: M. Neiburger (chairman), H. G. Houghton, and H. K. Work.

A site at Palestine, Texas, had been selected for the Scientific Balloon Flight Facility. The NCAR Panel on the Scientific Use of Balloons endorsed the choice of the site at its March 1962 meeting. It was deemed that the Palestine site offered a better combination of climatological conditions and trajectories for recovery of scientific payloads on a year-round basis than any other balloon-launching site in the country. Further, it is sufficiently removed from airways to make it possible to propose to the Federal Aviation Administration (FAA) that special rules be set up to permit launchings under conditions which elsewhere would be prohibited. Factors considered in selecting the general area of the country for the site were: the probable impact area for payloads, the winds at or near the surface, and the cloud cover. With these considerations, an area consisting of eastern Texas, southwestern Arkansas, and northeastern Louisiana was selected. Within this area finer criteria were applied:

- Remoteness from established airways.
- Proximity to an airfield suitable for support aircraft.
- Proximity to a city of sufficient size to provide adequate support services.
- Cooperative attitude of local officials.
- Suitable launching area, available at reasonable cost, free from present obstruction and protected against encroachment.
- Acceptable year-round local weather conditions.
- Predicted flight trajectories suitable for tracking and recovering payloads of high-altitude flights of about half a day's duration.

The installation would consist of a hardened launch area, an operations and laboratory building, helium storage facilities, and an inflation dome. It was planned to construct the paved launch area and the operations and laboratory building in the summer and fall of 1962. The facility would be operated by a private industry under a contract with UCAR and with close NCAR supervision.

By June 1962 the FAA and NSF had approved the Palestine site, although its final designation as a permanent site had to await Congressional approval. Martin P. Schwarzschild had announced that he would use the site for future launchings of his Stratoscope II flights.

The balloon facility would come under the Facilities and Administration division of NCAR as outlined in the organizational plan which the NCAR staff developed during 1962. This plan, presented as the NCAR Organization, Mission, and Mode of Operation, formalized the existence of three parallel divisions within NCAR: The Laboratory of Atmospheric Sciences, the High Altitude Observatory, and Facilities and Administration. There would be an associate director in charge of LAS (Thompson) and of HAO (Firor). The assistant director (Rex) would become an associate director responsible for Facilities and Administration. Each of these associate directors (of NCAR rather than of UCAR) would be director of his given division and would plan and direct programs of the division and coordinate its activities with those of the other divisions. This plan was approved at the October 1962 Board meeting, but the chairman was directed to appoint an ad hoc committee to review the organization plan. [2]

This ad hoc Committee on Organization, consisting of J. C. Calhoun (chairman), W. A. Baum, Robert L. Clodius, and John W. Hastie, held its first meeting in January 1963. Later in that year it heard and approved a further organizational change proposed by the NCAR staff which separated the division of Facilities and Administration into two sections. The new Facilities division would consist of a small staff concerned with planning and development of new facilities, operation and review of existing facilities and development projects, coordination of national survey groups and scientific advisory panels, conduct of clearing-house and technical-assistance functions, arrangement of appropriate conferences, and maintenance of field equipment. Three types of developmental activity were envisioned for this division: support facilities for NCAR, national facilities, and development projects to provide new techniques and field systems. Administration would be constituted as a

separate division charged with administrative and support responsibilities for the NCAR scientific divisions.

The research programs of NCAR were growing during this period, as well as the facilities. By the end of 1962 there were 14 programs under way in LAS. While the strongest emphasis was on atmospheric chemistry and physical meteorology, this was not felt to be a serious imbalance since the programs were built by the interests of the scientists involved rather than set by rigid formula. In any case, the Laboratory of Atmospheric Sciences was deemed at this point to have reached only 40 percent of its full strength. [3] HAO continued its work on the solar atmosphere and the earth's upper atmosphere. A highly successful eclipse expedition, in cooperation with SPO and NBS, was sent to New Guinea for the February 1962 total eclipse. By the end of 1962 work on the 16-inch coronagraph, with final funds provided by the Max C. Fleischmann Foundation, was essentially complete. (For the earlier history of the coronagraph, see Chapter III.)

Planning for the laboratory on Table Mountain was also proceeding. In July and August of 1962 the Planning Committee met with the architect, I. M. Pei, the NCAR staff, and the Advisory Committee of Architectural Deans. After this review, the Planning Committee provisionally approved the building and site plan (this approval was ratified by the Board at its October 1962 meeting). Pei was authorized to proceed with the detailed development of the plans for the first increment of construction. The director was authorized to seek construction funds from NSF. The preliminary plans were presented to NSF in November 1962 and were favorably received. It was planned to begin the first phase of construction of the buildings in the fall of 1963, but the plans were not ready for bids by then.

The need for additional temporary space before the completion of the Table Mountain building had been noted earlier in the year. Arrangements were made with the University of Colorado to lease space in a building similar to the 30th-street building occupied by NCAR and adjacent to it, which the university would construct. Occupancy was

scheduled for 1 January 1964. It was expected that the personnel capacity of the first 30th-street building (laboratory and office space for 150) would be filled before then. [4]

The Board of Trustees, while not increasing in size, underwent some personnel changes in 1962-1963. Malone resigned from the Board and Executive Committee as of June 1962. Kassander was appointed to fill his place on the Executive Committee and was nominated to be elected to fill his unexpired term at the next Board meeting. At that meeting, however, the bylaws were changed to make the vice-chairman (Kassander at that time) a member of the Executive Committee. Malone's place on the Executive Committee was not filled until the April 1963 Board meeting, when Jackson was elected to fill out the remaining one year of the term. Also at this meeting Jackson was reelected to another three-year term as trustee-at-large. Other trustees-at-large elected were: Henry Eyring (one-year term), R. L. Stearns (two-year term), and P. E. Klopsteg (three-year term). Newton had resigned as trustee-at-large. Other elections at this meeting were:

Executive Committee (three-year terms): G. S. Benton,  
 J. W. Hastie, J. C. Calhoun Jr.  
 Secretary-Treasurer: M. A. Farrell  
 Assistant Secretary and Assistant Treasurer: R. J. Low

During 1963 the much-discussed question of participation in UCAR was finally settled. The Committee on Participation made its second report to the Executive Committee and the Board at their October 1962 meetings (its first report was in June 1962, see above). The report stated that there was, in fact, external pressure to expand membership and that some ten universities were interested in becoming members. When UCAR started out, the original members were almost the only universities offering Ph.D. programs in the atmospheric sciences, but by 1962 more universities were offering such programs and they felt that membership in UCAR had prestige value. The report went on to state that two courses appeared to be open to the Board:

- Freeze membership at the present size, making it clear that the facilities of NCAR are open to all universities.



- Admit all interested universities meeting certain objective criteria relating to their academic and research programs in the atmospheric sciences.

The latter course would necessitate the reorganization of the structure of the corporation to form a smaller board. This action would not be necessary immediately, but the Board should plan for the future. A possible form of reorganization would be to have an annual meeting of members which would elect a small (10- or 12-member) Board of Trustees with long terms of office (six years) to provide continuity.

No action was recommended by the committee, but full discussion was requested since the committee felt that there was still considerable difference of opinion within itself, the Executive Committee, and the Board. Discussions did follow, both at these October meetings and at later ones. At the October Executive Committee meeting Floe was appointed to the participation committee to fill the vacancy left by Malone.

Discussions about participation almost always centered on the problems of management which an expanded membership would bring. Objections to expansion were primarily that it would create a lack of effectiveness in management and would breed a lack of a feeling of responsibility in the individual members. Some trustees felt that the problem was really one of communication and that if the outside universities really understood the functions and purposes of UCAR and NCAR, then these universities would no longer feel obliged to seek admission to UCAR. Droessler, the NSF representative at these UCAR meetings, felt that support for UCAR would be facilitated if it embraced a broad segment of the universities active in the atmospheric sciences. [5] Some of the trustees also expressed their feeling that it was important for UCAR to be broadly representative of and to marshal support for the atmospheric sciences in the country. It was further pointed out by those in favor of expansion that there were advantages of membership, and also that there was prestige in membership.

The participation committee reported to the April 1963 meeting of the Executive Committee that it had held a meeting with representatives\* of non-member universities (despite the reservations expressed about such a course at the October 1962 Executive Committee meeting). The conclusions which the participation committee drew from these discussions were that: feeling concerning the structure of UCAR on the part of non-members was so strong that further delay in broadening participation was inadvisable; precipitate action to change the management structure was neither feasible nor desirable. From these conclusions the committee proceeded to the following outline of recommendations for action:

- I. Change the bylaws to redefine the functions of member universities.
  - A. Membership in UCAR is to be open to all universities meeting certain specific requirements (to be set by the Board or the reconstituted membership).
  - B. There is to be a minimum of one meeting a year of the members' representatives.
  - C. The responsibilities of the members are to:
    1. Advise the Board and the director concerning scientific matters of concern to UCAR.
    2. Assist the director in carrying out scientific objectives.
    3. Establish criteria for membership and elect new members.
    4. Carry out other functions of general interest to the scientific community of universities active in the atmospheric sciences.
  - D. Members shall pay a moderate annual fee to defray meeting travel expenses.
  - E. All present members shall become members in the redefined sense.

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\*These representatives were: Homer T. Mantis (University of Minnesota), J. Vern Hales (University of Utah), Herbert Riehl (Colorado State University), and Wendell A. Mordy (University of Nevada). Richard M. Goody (Harvard University) had also been invited but was unable to attend.

- II. The management function shall continue to be the responsibility of the Board of Trustees, in its presently constituted form. The Board shall retain full legal responsibility for the management of UCAR.

While the discussions which followed this presentation indicated that there was still some division of opinion, among members of the Executive Committee at least, the Board adopted the recommendations of the participation committee. The Board then approved amendments to the certificate of incorporation which set up different classes of membership along the lines suggested in the report of the participation committee. These amendments were submitted to and approved by a meeting of members on 25 June 1963.

Although the expansion of UCAR had now been accepted, in principle, the detailed changes in the bylaws had yet to be worked out. The participation committee worked on these amendments and, after consultation with the Executive Committee, presented their final report in the fall of 1963. The bylaw amendments, approved by the Board at its October 1963 meeting, set up the Council of Members (each member was to have one representative on the council) with duties as outlined in the participation committee's report (April 1963, see above), specified that the annual fee should be the same for all members, and set the maximum number of trustees-at-large at six (to be nominated by the council, but elected by the Board). The chairman was also authorized to appoint a Committee on Membership of five members broadly representing the atmospheric science community. The committee was to consider for membership only those institutions with programs for a doctorate in atmospheric science which had granted two doctorates within the past three years. The participation committee was discharged in January 1964.

One of the possible functions which had been envisioned for the Council of Members was to receive the annual research review. Such reviews were at this time received by ad hoc committees of the Board. HAO and LAS reviews were done separately, in fact it was felt necessary to have different reviewers for different sections of LAS. In addition to an outside reviewer, the program leaders within NCAR were expected to make annual written reports on progress in their areas.

The Facilities division, organized as a separate division in the spring of 1963, had further internal and external advisory and review controls. An NCAR Facilities Advisory Group was established which was made up of NCAR staff and which would advise the director of Facilities on the planning and development of new facility programs. For the consideration of the individual facilities there were two other groups recruited from non-NCAR experts in that particular field--the NCAR National Survey Group and the NCAR National Scientific Advisory Panel. The former was to determine the nature and scope of the national need for a particular facility and what, if any, NCAR's role should be in meeting that need. The advisory panel would be appointed after the facility had been established to advise on overall scientific and policy matters affecting the facility.

An advisory panel for the balloon facility (then called the NCAR Panel on the Scientific Use of Balloons) had been in existence since 1961. The next national facility to be considered was the aircraft facility. In the fall of 1962, in cooperation with the U.S. Weather Bureau, NCAR undertook a preliminary survey of aircraft needs of individuals and institutions active in atmospheric science. When this survey was completed a National Aircraft Survey Group was formed in the summer of 1963. The group consisted of: Fred C. Bates, John C. Bellamy, Roscoe R. Braham Jr., Robert M. Cunningham, James G. Edinger, John W. Hinkelman Jr., Dwight B. Kline, and Robert A. Ragotzkie. At their first meeting in July 1963 Ragotzkie was elected chairman. At this meeting they adopted the plan of answering specific questions in regard to what aircraft requirements existed that could not then be met, what the priorities of these requirements were, and how they could best be met.

The aircraft survey group presented its final report in early 1964. In it the group recommended that a national aircraft facility be established and that this be done by NCAR. In particular, the report called for NCAR to provide information, advisory, and liaison services, to establish a training program in the techniques of aircraft observation, and to begin immediately to acquire and operate research aircraft on an

in-house basis. The experience gained from serving NCAR staff needs should then lead in the near future to the establishment of an aviation facility to meet a significant proportion of the needs of the university atmospheric sciences community. [6] At its March 1964 meeting the Executive Committee authorized the director to proceed with the establishment of an aircraft facility along the lines recommended by the National Aircraft Survey Group.

An NCAR computing facility was also authorized at this March meeting of the Executive Committee. The computing facility had had no survey group since it had, in fact, been planned as an in-house facility rather than as a national facility (although the latter possibility had been considered). The Computer Committee (of the Board of Trustees), appointed in 1962, had considered the merits of the new larger computers and had come to the same conclusion presented in the computer report of April 1962 (see above) that the Control Data 6600 computer would be the best choice for NCAR. While NSF had originally thought that this item could be budgeted, perhaps for FY 1965, it was consistently deleted from the NCAR budget proposals by NSF. Finally, in the early fall of 1963, the Subcommittee on Atmospheric Sciences of the President's Science Advisory Committee (John W. Tukey Committee) considered NCAR's request for funds in FY 1965 to finance the acquisition of the computer. This committee concluded that NCAR's in-house capability in computer technology and in scientific areas that were highly computer-oriented was not sufficiently developed. Therefore, NCAR could only justify the computer on the basis of its use, in part, by outside users. The NCAR staff then moved to lease a Control Data 3600 (installed in November 1963) and proceeded to establish, with the Computer Committee's approval, a joint-use computer facility. (At the March 1964 Executive Committee meeting, national facilities were redesignated as joint-use facilities.)

It was not only in the matter of the computer that the overall NCAR budget plans suffered cutbacks during this period. The FY 1963 budget, which had begun as a request for \$7 million, ended up at \$5 million when Congress finally passed the appropriation in late 1962. The budget for FY 1964 included funds for construction, so that the

original request from NCAR came to \$11 million. The Bureau of the Budget cut this to \$9 million and, although NSF agreed in early 1963 to work to have the full amount restored, this figure remained the final one. The large computer entered NCAR's budget planning for FY 1965. In a budget statement approved by the Board in April 1963, \$11.3 million was requested for the computer and \$13.6 million for other operations. The item for the computer was promptly thrown out of the budget request and, after the Tukey Committee report, had little chance of being restored. The remainder of the request was slowly whittled away until the final amount came to only \$7.8 million.

At the same time, the management fee was being increased. In the summer of 1962 Paul M. Scherer of NSF had suggested that part of the management fee be set aside to build up some working capital for the corporation. He further suggested that an additional amount be allocated as "venture money" to enable UCAR to make expenditures which were imaginative and supportive of the overall goals of the center when immediate action seemed necessary. This Venture Fund, as it became known, was set up by the Executive Committee in January 1963 when it empowered the director to spend up to \$20,000 of the management fee for ". . . such activities, beyond the scope of the normal programs of NCAR, as may be of significant benefit for the atmospheric sciences." [7] The first commitment of the Venture Fund was made later in the spring of 1963 to initiate a joint AMS-UCAR appointment for a distinguished visiting research scholar to be named in honor of Carl-Gustaf Rossby. The appointee would be chosen by AMS and would spend six months at NCAR. AMS approved the principle of the Rossby Fellow later in the year.

UCAR was able to reactivate its own graduate fellowship program in 1963 with a \$20,000 grant from the Kettering Foundation. The chairman appointed a Fellowship Committee (Rev. Victor J. Blum, S.J. (chairman), John R. Winckler, and P. D. Thompson) to administer the program. Two fellowships were awarded in 1963; one new award was made in 1964.

There had never been any question about whether UCAR should accept outside private funding, such as the grant for the fellowship program.

The question of NCAR accepting non-NSF funds from federal agencies, however, was one that raised considerable discussion during 1963-1964. The Board, in April 1963, passed a resolution (the director had requested a statement of some policy on this point) that UCAR would not solicit funds from federal agencies other than NSF for the operation of NCAR in any amount in excess of approximately 10% of the NSF budget for NCAR. As budget cuts proceeded, and in particular when it appeared that funds for the computer would not be forthcoming, this policy became a matter for debate. The director strongly felt that a single-source funding policy would add to the security and stability of NCAR's support, since it would assure NCAR of the strong support of one agency rather than partial support from several, with none of them shouldering full responsibility. Further, he felt that having NCAR as a single line item in the budget of one agency would mean less competition between NCAR and the universities for funds for separate research projects. The Board, at its April 1964 meeting, adopted a motion confirming UCAR's intent to operate under a single-source funding arrangement with NSF for the operations of NCAR. The motion, however, left UCAR free to enter into ad hoc funding arrangements with outside agencies for special items, but not for routine funding of research and facilities. The 10% scheme was dropped entirely since technical difficulties had arisen from it due to the various agencies' different budget cycles.

The National Aeronautics and Space Administration (NASA) was one of the other government agencies with which NCAR had many dealings. In 1963 NASA gave NCAR a contract to conduct a number of scientific balloon flights and to do developmental and test work on various technical problems of general value to the development of scientific ballooning. In the following year NCAR obtained a NASA contract for the development and construction of a satellite-borne coronagraph scheduled for inclusion in the first Advanced Orbiting Solar Observatory (AOSO was cancelled in late 1965, but the coronagraph was adapted for use in a later spacecraft series). This project was in the hands of the HAO staff who were already working on a balloon-borne coronagraph (Coronascope II) under an ONR contract dating back to 1957.

HAO had held many contracts from a number of agencies. One of the problems of establishing NCAR's single-source funding policy lay in phasing out these various HAO contracts. HAO's operations were completely integrated under the NSF contract by the beginning of FY 1964, but a number of outside contracts were maintained for some years to come--in particular the one from 1960 with Air Force Cambridge Research Laboratories (AFCLR) to provide personnel and services at the Sacramento Peak Observatory (see Chapter III).

At the same time, HAO's formal relations with the University of Colorado were also being phased out. Staff members holding joint appointments at CU and HAO, after 1 July 1964, held their appointments from CU alone or from NCAR alone. Their formal relations with HAO would be those of any other visitor from a university. The NCAR policy on visiting scientists, which these people now came under, had been approved by the Board in October 1962.

Most of the visitors at NCAR in the first few years were there only for the summer or an even shorter period. A need was felt to strengthen the visiting scientist and postdoctoral fellowship programs. In the fall of 1963 a new program (which became known as the Advanced Study Program) was proposed which would consist of a series of formal lecture-seminars on advanced research topics to be conducted by senior research scholars. The object of the program was to expose recent Ph.D.s, and less recent ones who had had limited research opportunities, to a wide variety of problems in the atmospheric sciences and to provide them with opportunities to pursue some of those problems in depth. It was also hoped that this program would draw into the atmospheric sciences people from the other allied sciences. While it was envisioned that there would be about ten one-year appointees in the program each year, during 1964 only three postdoctoral appointments were made due to the general lack of funds.

At the October 1963 Board meeting the director was authorized to direct Thompson to special assignments (in this case the direction of the new ASP program) and if necessary, to relieve him of responsibility



for LAS. Upon the director's recommendation, William W. Kellogg was appointed to serve as director of LAS and associate director of NCAR. There had been few other changes in the organization or administration of NCAR since early 1963 (see above). The Director's Committee, consisting of the director and the three associate directors, was formed (or perhaps more accurately formalized) to coordinate the divisions' work and to consider overall NCAR policies. The director had added a small UCAR staff to aid him with UCAR-related business during 1963. The NCAR Manual, which described the organization, policies, and staff positions of NCAR, was being prepared by the NCAR staff with advice and help from the trustees, particularly Calhoun.

A major change in organization did take place in early 1964 when the post of director of Facilities and Administration was abolished and in its place was established the two positions of director of Facilities and assistant director for Administration. Rex was appointed to fill both positions, although Fred W. Roecker was designated to serve as acting assistant director for Administration (in the fall of 1964 Roecker was formally appointed as assistant director for Administration). An organization chart for NCAR for this time is given in Fig. 1.

During this period facilities were developing steadily, if not always smoothly. The Scientific Balloon Flight Facility in Palestine, Texas, went into full-scale operation in August 1963. During its first full year of flight operations 83 flights were launched, of which 68 were scientific flights and 15 were balloon development or test flights. Physical facilities at the station included a hardened launch area, a laboratory and operations building, and a warehousing and staging building. Plans for the shelter had to be continually delayed due to budget restrictions. NCAR had made an agreement with the Bureau of Reclamation for the use of a site at the base of the Glen Canyon Dam (Page, Arizona), which was to have modest facilities for winter launches. [8]

The study of a new type of facility was undertaken in the fall of 1963 with the formation of the National Meso-Micrometeorology Facility

Survey Group. Members of the group were: Morton L. Barad (AFCRL), Joost A. Businger (University of Washington), Tetsuya Fujita (University of Chicago), Heinz Lettau (University of Wisconsin), Donald H. Pack (U.S. Weather Bureau), Hans A. Panofsky (Pennsylvania State University), and Donald M. Swingle (U.S. Army). Panofsky was elected chairman. The group's report, issued in March 1964, recommended the establishment of a meso-micrometeorological facility, but they did not specify what NCAR's role should be. [9] It was suggested that NCAR should focus its efforts on specific problems arising within its own research areas and on the development of particular instrumentation critically needed in mesoscale research. [10]

Development of the aircraft facility was proceeding in the spring of 1964 with arrangements for the lease of a Beech Queen Air 80 aircraft which had been extensively modified (with special antennas, communications gear, amplifiers, recorders, etc.) by the renter, Combs Aircraft, Inc. The purchase of an aircraft could not be carried out until the next budget year when special Congressional authorization language would have to be included in the appropriation act granting the funds. In May (to the surprise of NSF as well as NCAR) the Comptroller General handed down a ruling that the restrictions on the use of NSF contract funds for the purchase of aircraft also applied to the lease of aircraft services. NSF thus had no choice but to refuse to approve the subcontract with Combs. They also had to ask NCAR to proceed to cancel the subcontract with Raven Industries, Inc. for tracking aircraft services for the balloon flight facility at Palestine. Since these latter aircraft services were essential for the safe operation of the balloon facility, cancelling them would also have meant cancelling all balloon flights.

The director then, with the concurrence of Chairman Byers, committed \$28,587 of the Venture Fund for the four-month lease of the Queen Air 80 aircraft. The Executive Committee, at their July 1964 meeting, approved and confirmed the director's action. At this time the Venture Fund was made into a revolving fund to be restored to \$40,000 each year.

The director was instructed to take all reasonable steps to support the balloon flight facility.

The NCAR Aviation Facility Advisory Panel was named in the spring of 1964. It consisted of: Charles E. Anderson (Douglas Aircraft), Fred C. Bates (University of Kansas), Roscoe Braham Jr. (University of Chicago), Armin J. Deutsch (Mt. Palomar Observatory), R. C. Gentry (U.S. Weather Bureau), Robert A. Ragotzkie (University of Wisconsin), and Herbert Riehl (Colorado State University). At their first meeting in May, Braham was elected chairman. They made recommendations for evaluating requests of non-NCAR scientists for facility services, for reports by the facility staff to the panel, and for the publication of information.

Control Data Corporation had announced that spring that it would, as of 1 July 1964, sharply reduce the lease rates on both its 3600 and 6600 computers. Since this action would be expected to increase the commitments of Control Data, Director Roberts had promptly executed a conditional contract (the conditions being the approval of both UCAR and NSF, as well as the availability of funds) for the lease of a Control Data 6600 beginning on or about 1 July 1965. UCAR would have until 1 May 1965 to ratify the contract. The matter would be further reviewed by the Computer Committee and the NCAR Computing Facility Advisory Panel\* (formed in the spring of 1964) before the UCAR Board or Executive Committee would be asked to act on the contract.

The other divisions of NCAR, as well as outside users, made use of the services offered by the Facilities division. In March 1964 HAO launched the first flights of Coronascope II with the support of the balloon facility. This flight obtained 118 photographs of the corona at an altitude of 100,000 feet. Of HAO's other equipment, the 16-inch coronagraph was in full use by 1964 and the K-coronameter (Koronameter)

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\*Chairman: Cecil E. Leith (Lawrence Radiation Laboratory; Members: Arthur N. Cox (Los Alamos Scientific Laboratory), Eugene Isaacson (Courant Institute of Mathematical Science), Yale Mintz (UCLA), Norman Phillips (MIT), and Aksel Wiin-Nielsen (University of Michigan).

had been moved to Hawaii. The weather at Climax severely limited the capabilities of the Koronameter, so a joint venture with the University of Hawaii was entered upon and the instrument was taken to Mt. Haleakala on the island of Maui in the fall of 1963. The number of observing hours per day and observing days per year at this station, set up by the University of Hawaii in 1962, did prove to be substantially greater than at Climax.

During this period HAO continued its studies of the average conditions of the solar atmosphere, of solar activity (in the x-ray, ultraviolet, and radio as well as optical ranges), and of interplanetary space and the earth's magnetosphere. LAS tended to emphasize studies of the middle and lower atmosphere and at this time was concentrating on three broad areas of research: the general circulation of the atmosphere, cloud physics, and the life cycles of the trace gases and aerosols in the atmosphere. It was felt that there were areas where the programs of LAS should be strengthened, such as in studying the dynamics of ocean circulation and air-sea interactions. [11]

As the divisions of NCAR were increasing in staff and facilities, plans for the laboratory on Table Mountain were proceeding more slowly, but construction was under way before the end of 1964. In the summer of 1963 the Planning Committee met with architect Pei to review the final preliminary plans, cost estimates (somewhat over \$4.5 million), and construction schedules. On the advice of legal counsel and others it was decided to prequalify bidders for the construction contract in order to eliminate those deemed unqualified on the basis of their past performance or other criteria. The Planning Committee, in March 1964, reported that 17 firms had qualified under the prequalifying procedures and they were invited to bid later in the month. Five bids were received and the contract was awarded to the low bidder, the Martin K. Eby Construction Company of Wichita, Kansas. The contract was signed with Eby on June 5 for the total amount of \$4,558,943. A groundbreaking ceremony was held on 9 June 1964 with city and state officials and NCAR staff present.

At the same time that the NCAR permanent laboratory was at last beginning to take material shape, UCAR was making its final moves toward the restructuring of the corporation and the admission of members. The establishment of a Committee on Membership had been authorized in the fall of 1963. By the beginning of the following year a committee consisting of H. G. Houghton (chairman), G. S. Benton, P. E. Klopsteg, G. A. Pettitt, and Ralph Bolgiano (appointed later that spring), had been appointed. Universities which had expressed an interest in joining UCAR were informally informed of the new admissions policies. By March of 1964 applications for admission to membership had been received from the University of Colorado, Colorado State University, and the University of Texas.

The University of Colorado was elected to membership in UCAR at the April 1964 Board meeting. There followed a discussion of the criteria for membership. It was felt that the previously set criterion of having granted two Ph.D.s within the past three years might need to be relaxed in the cases of some universities which had made a clear commitment to the atmospheric sciences, such as by having established a department in the field. The Board adopted an amended recommendation by the Committee on Membership that "a university be considered eligible for membership if it has made a clear and continuing commitment to a program of course studies and thesis research leading to the doctorate in the atmospheric sciences or closely related fields, provided that the university can present evidence of continuing scholarly productivity in its program." [12]

The UCAR Board and Executive Committee were also carrying on some minor changes in their own organizations and procedures during this period. At the June 1963 Executive Committee meeting it was decided that the Executive Committee should hold its meetings at times other than those of the Board meetings; prior to this decision, each of the regular biannual Board meetings had been immediately preceded by an Executive Committee meeting. At this meeting it was also decided, on the recommendation of the ad hoc Committee on NCAR Organization, that two separate persons should hold the posts of secretary and treasurer.

With the resignation of Farrell as secretary-treasurer, Baum was elected secretary and Church treasurer at the October 1963 Board meeting.

In January 1964 Baum resigned from the Board (he had moved to a non-member university) but remained as secretary, since under the by-laws neither the secretary nor treasurer needed to be a trustee. In the Board elections of April 1964 Baum was reelected secretary and Church was reelected treasurer. Other elections at that meeting were:

Trustees-at-Large (three-year terms): Henry Eyring  
and Fred L. Whipple  
Executive Committee (three-year terms): Alfred Blackadar,  
Paul E. Klopsteg, and Gilbert L. Lee Jr.

Blum was elected to fill the unexpired Executive Committee term of Baum. Roecker was elected to serve a one-year term as assistant treasurer. The new Nominating Committee was D. F. Leipper (chairman), H. G. Houghton, and R. L. Stearns.

Several new Board committees were also established during 1963-1964. An Audit Review Committee, which grew out of recommendations by the ad hoc Committee on NCAR Organization a year earlier, was appointed in the spring of 1964. This committee, consisting of G. L. Lee Jr. (chairman), C. F. Floe, and W. S. Jackson, was to perform such duties of an advisory nature as the treasurer of UCAR should require. [13] In early 1963 Chairman Byers suggested, and Director Roberts endorsed, the establishment of a committee to study the overall financial support of the atmospheric sciences. The Committee on Financial Support for the Atmospheric Sciences was appointed in the spring of 1963; its members were W. O. Roberts (chairman), D. F. Rex, V. E. Suomi, and Francis S. Johnson. Questionnaires were sent out to about eighty people working in the atmospheric sciences asking for their views on the adequacy of financial support and related matters. The replies (received from 51 persons) were summarized and presented in the spring of 1964. After the creation of the Council of Members in the fall of 1964, the Board felt that the function of this committee should be transferred to the council.

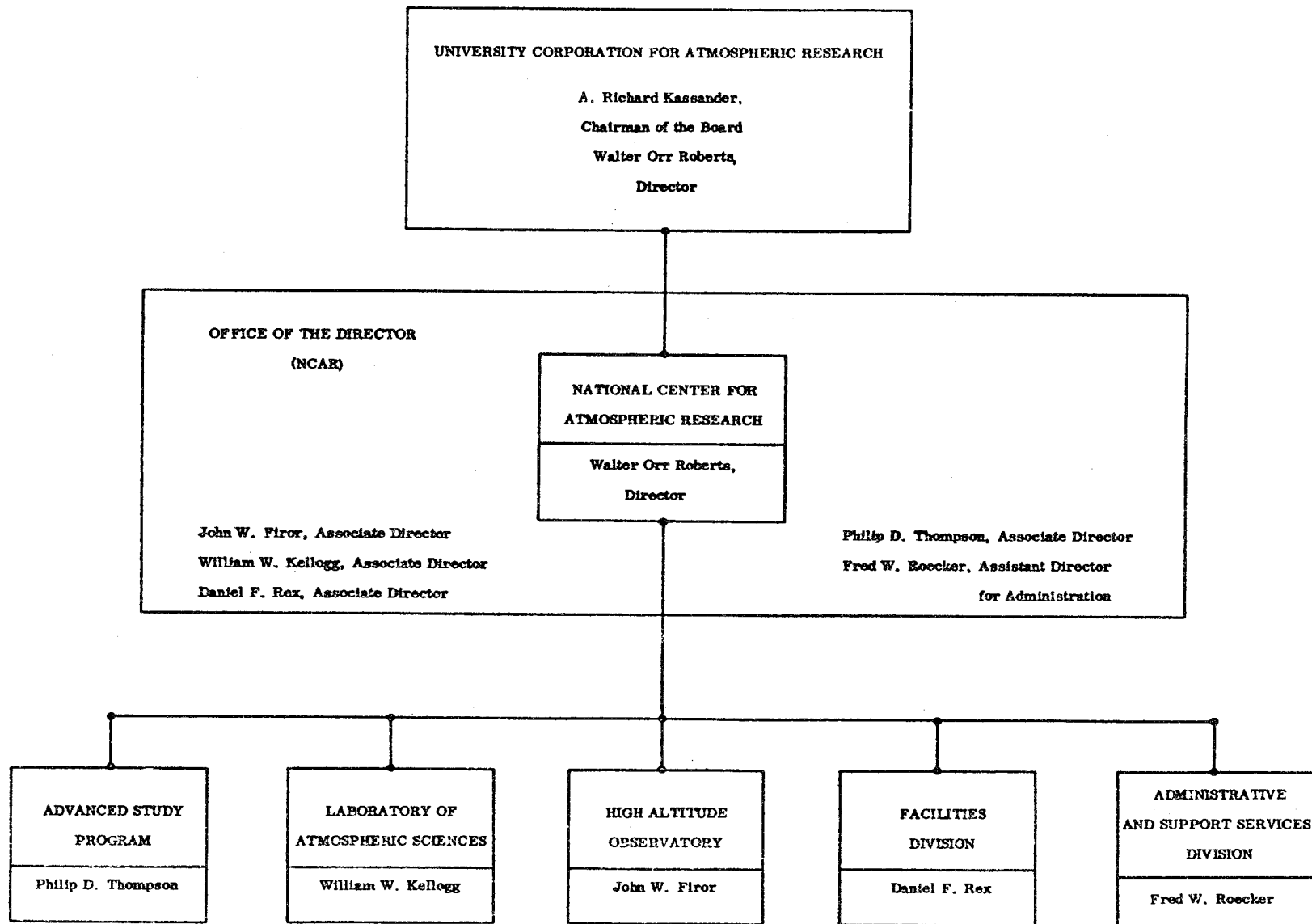
The councilors were selected in the same way that the trustees had been. On 12 June 1964 the secretary of the Board sent a letter to the chief executive officer of each of the member universities asking them each to appoint a councilor to represent their university. The scientific advisory function of the council was pointed out in this letter, but it was advised that someone other than the scientific trustee on the UCAR Board be appointed as the university's councilor. The first meeting of the Council of Members was held on 12 October 1964.

NOTES

1. Minutes of the meeting of the Executive Committee of UCAR, 26 June 1962, pp. 11-14.
2. Minutes of the meeting of the Board of Trustees of UCAR, 9 October 1962, p. 13.
3. Reports of Research and Facilities Programs, NCAR, 1962, pp. 3-5.
4. Report of the Director, 15 June 1962, p. 19. Contained in Materials for the meeting of the Executive Committee of UCAR, 26 June 1962.
5. Minutes of the meeting of the Board of Trustees of UCAR, (Rump Session), 9 October 1962, p. 1.
6. An Aviation Research Facility for the Atmospheric Sciences. Report of the NCAR National Aircraft Facility Survey Group. NCAR Technical Notes 64-1. 1964.
7. Minutes of the meeting of the Executive Committee of UCAR, 17 January 1963, p. 15.
8. Reports of Research and Facilities Programs, NCAR. 1963, pp. 67-68. Ibid. 1964, p. 16.
9. Meso-Micrometeorological Requirements for the Atmospheric Sciences, NCAR Technical Notes 64-2, 1964.
10. Reports of Research and Facilities Programs, NCAR, 1964, p. 38.
11. Ibid., pp. 129-130.
12. Minutes of the meeting of the Board of Trustees of UCAR, 14-15 April 1964, p. 12.
13. Minutes of the meeting of the Executive Committee of UCAR, 4-5 March 1964, p. 7.



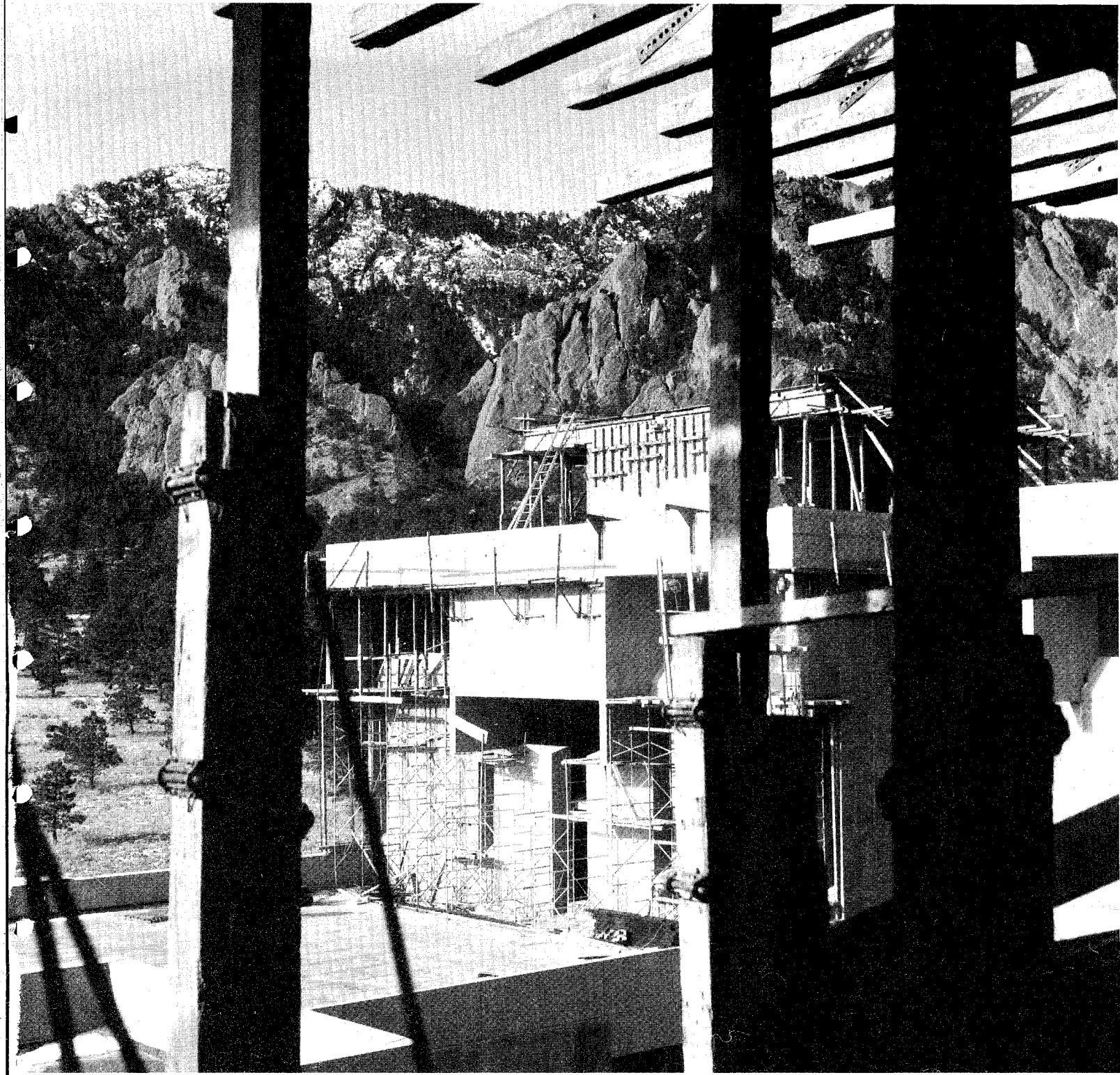
# ORGANIZATION CHART THE NATIONAL CENTER FOR ATMOSPHERIC RESEARCH



UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH

Figure 1





NCAR Laboratory at Table Mesa under construction, 1965



## CHAPTER V

THE COUNCIL OF MEMBERS

At the first meeting of the Council of Members in October 1964, Chairman Byers (the chairman of the Board of Trustees was also chairman of the Council) outlined the stated and suggested responsibilities of the Council. [1] These responsibilities were:

- To serve as the principal UCAR review body and to represent the interests of the university community.
- To recommend the election of trustees-at-large.
- To pass on the applications of prospective new members of UCAR.

It was the consensus of the council that the committee charged with planning the review of NCAR should also look into the goals of NCAR.

The chairman appointed an ad hoc committee (A. C. Wiin-Nielsen, R. G. Fleagle, and Paul Ebaugh) to make recommendations on the composition of council committees and related matters. On the recommendation of this group, the following committees were approved by the council:

Membership Committee: Zdenek Sekera (chairman),  
Ben Davidson, Charles L. Jordan

Review and Goals Committee: Robert G. Fleagle (acting  
chairman), Louis J. Battan, Henry G. Booker,  
Norman A. Phillips, Owen M. Phillips, George W.  
Platzman

Trustees-at-Large Committee: Aksel Wiin-Nielsen (chairman),  
Paul Ebaugh, Robert Ragotzkie

No term was specified for committee membership.

During discussions of the structure of the council, the point was made that the structure of the current Council and Board was probably in a transitional state and that it would be appropriate for the council to study this structure and to make recommendations to the Board about it. It was also felt that the council should, in the future, be allowed

to choose its own officers. The council passed a resolution recognizing the usefulness of the current executive arrangement but foreseeing that it might not be the best permanent arrangement.

The next meeting of the Board, later in October 1964, changed the bylaws to set the council's annual meeting for March rather than October so that it might fall closer to the Board's annual meeting. Also at this meeting the Board's Committee on Membership was discharged (after having made its report), since its function would be taken over by the Council's Membership Committee.

The final report of the Board's Committee on Membership included nominations of new members. Colorado State University, the University of Texas, the University of Alaska, and the University of Utah were elected to membership in UCAR. The committee also recommended, and the Board adopted, a policy that only universities or equivalent academic institutions be considered eligible for membership. The committee's recommendation on the termination of membership was referred to the council.

When the council next met, in March 1965, it made nominations for trustees-at-large and recommended two universities for membership in UCAR. The main business of the meeting, however, was the consideration of the report of the Evaluation and Goals Committee (formerly the Review and Goals Committee). The committee had subdivided its responsibilities into the following sequence:

- Procedures for evaluating the NCAR research program.
- Examination of NCAR goals.
- Procedures for evaluating NCAR facilities.
- Procedures for evaluating postdoctoral fellowship and other educational activities of NCAR and UCAR.

The committee's report at that time considered only the problem of evaluating the NCAR research program. The committee both endorsed the director's plans for an internal review and recognized the need for an independent review by the council. They suggested a review procedure

similar to that used by NSF in evaluating university research proposals. The steps would be:

- The director would annually provide the committee with a list of current research activities organized around coherent scientific objectives.
- The Evaluation and Goals Committee would select one-third of the programs for a comprehensive review. Project scientists would then prepare documents describing and justifying their proposed research just as would be done in a research proposal to NSF.
- Brief summaries of research would be requested from the remaining two-thirds of the programs.
- The Evaluation and Goals Committee would then submit the detailed proposals to NSF for an anonymous review following normal NSF procedure.
- With these reviews, a continuing review of NCAR research publications by the Evaluation and Goals Committee, and discussions with the NCAR directors and scientists, the committee would have a basis for its annual evaluation.
- The evaluations and recommendations of the Evaluation and Goals Committee would be discussed with the director and reported to the council.

The committee also recommended that the NCAR administration seek key scientific leaders from any available source (i.e., not just from the universities) and that the chairman of the council, on the recommendation of the Evaluation and Goals Committee, be free to appoint to that committee scientists from institutions not necessarily members of UCAR. All sections of the committee's report were approved by the council. [2]

In other action at this meeting, the council approved a proposal that each council member should submit an annual report concerning the research and degree-granting activities of his institution. On a question from the director, it was the consensus of the council that it would be proper and useful for NCAR to be designated as a WMO National Research Institute. Such institutes would be expected to accept as visitors qualified foreign scientists designated by WMO.

In other areas of international cooperation, NCAR was already participating in International Quiet Sun Year balloon experiments in India. By the summer of 1965 Lally had been appointed head of a joint U.S. New Zealand program for a major feasibility test of constant-density level balloons. For the United States the program was sponsored jointly by NCAR and the U.S. Weather Bureau. The development of this global horizontal sounding technique (GHOST) was seen as part of the preliminary work for a three-dimensional global observing network.

With Lally's appointment to the GHOST program, Alvin L. Morris was appointed manager of the NCAR Scientific Balloon Flight Facility in his place. The balloon facility was at that time having some problems with the operation of the Palestine station. In 1964 an NSF decision made the continued operation of the station by a subcontractor subject to annual competitive bidding. Since this circumstance would preclude the development of a permanent experienced operating team, the NCAR staff had decided that NCAR should operate the station rather than a subcontractor; the Balloon Facility Advisory Panel had approved the decision. The private balloon contractors had, however, objected strongly to this decision. An arrangement was finally worked out by the summer of 1965 whereby the subcontract for operating the Palestine station would be put up for competitive bidding on a two-year basis. In the fall of 1965 Winzen Research, Inc., of Minneapolis, Minnesota, was awarded the contract for the operation of the station.

In the fall of 1964 a new facility was created at NCAR, the Field Observing Support Facility. This facility, later made into a joint-use facility (see below), was to provide radar, measuring devices, and other support for scientists working in the field. The lease of the Control Data 6600 for the computing facility was approved by the Board at its October 1964 meeting. Installation of the computer was scheduled for the summer of 1965, but was not completed until May 1966. Control Data had, in the spring of 1965, made a research grant to NCAR of free time on the Control Data 6600 for usage of the computer in excess of one shift.



In early 1965 the NCAR aviation facility projections for the use of its aircraft in the coming season showed that there was again a need to lease more aircraft than the language of the NSF appropriation allowed for. The staff predicted that two Queen Air 80 aircraft would be fully utilized, as well as the tracking aircraft for the balloon facility. Since the appropriations language only allowed for the lease of two aircraft, the NCAR staff suggested, and the Executive Committee approved, the use of unallocated funds of UCAR to lease the tracking aircraft for the balloon station. [3]

In the course of the discussions on the lease of the additional aircraft at the January 1965 Executive Committee meeting, the question of NCAR's long-range policies on facilities use arose. The appointment of a committee to study the question was authorized at that meeting. The chairman had appointed the ad hoc Committee on Facilities-Use Policy, consisting of A. Blackadar (chairman), Ben Davidson, Orvin W. Campbell, and Karl Dittmer, by the March 1965 meeting of the Executive Committee.

At this meeting the chairman also appointed an ad hoc Committee on Policies Governing NCAR Staff Relations with Universities consisting of E. W. Hewson (chairman), Ross E. Heinrich, Elburt F. Osborn, and F. L. Whipple. This committee was to receive, and to report to the Board on, a staff report on general policies regarding relations among NCAR, its senior and junior scientific staff members, and the universities. Director Roberts had already introduced, at the January 1965 Executive Committee meeting, the idea of affiliate professorships for NCAR staff. The object of the arrangements would be to encourage NCAR staff to enter into long-term affiliations with universities as bona fide staff members. NCAR would grant a certain amount of time each year for the staff members' university duties and they would be encouraged to spend a semester every two years at the university. The Executive Committee considered the general idea a good one and approved, in principle, the appointment of Patrick Squires as an affiliate professor at Colorado State University.

The ad hoc committee made its report on NCAR staff relations with the universities to the Board at its October 1965 meeting. The committee report expressed approval of the NCAR Affiliate Professorship Program. The program, in general, presented in more detail the basic ideas outlined by the director earlier in the year. A term of three years was set for the appointments during which the NCAR staff member was expected to spend a full semester at the university at least once. NCAR would provide one-half the salary for these longer visits and would fully support visits of up to six weeks a year in connection with the staff member's university obligations. [4]

UCAR meanwhile continued the election of new member universities. At the April 1965 meeting of the Board, following the recommendations of the council, the University of Minnesota and the University of Hawaii were elected to membership. This Board meeting also marked the end of UCAR's sixth year and the end of the terms of the chairman and the vice-chairman.

The new officers elected were:

Chairman: A. R. Kassander  
 Vice-Chairman: J. C. Calhoun Jr.  
 Secretary: W. A. Baum  
 Treasurer: P. E. Church

New members of the Executive Committee were:

H. R. Byers  
 S. L. Hess  
 Thomas R. Rogers  
 O. W. Campbell (to fill the vacancy created by the  
 election of Calhoun as vice-chairman)

Trustees-at-Large were:

W. T. Golden  
 A. T. Waterman  
 E. L. Mosley (to fill out a two-year term)

Wolff was appointed assistant secretary and Roecker assistant treasurer of UCAR.

After the election of its own officers, the Board reopened discussion concerning the officers of the Council of Members. Following considerable discussion the general counsel was directed to prepare amendments to the bylaws which would enable the council to elect its own chairman, vice-chairman, and secretary. The chairman of the Board, or his designee, would be entitled to attend all meetings of the council but not to vote. Similarly the chairman of the council, or his designee, would be entitled to attend all meetings of the Board but not to vote. These amendments to the bylaws were duly passed by the Board at its October 1965 meeting.

Another action taken by the Board at its April 1965 meeting was the authorization of the director to appoint an associate director whose work would be concerned with the responsibilities of NCAR in the area of applications of the knowledge of the atmospheric sciences. [5] The director and associate directors immediately began working on this concept of an applications division and presented preliminary guidelines to both the Executive Committee and the Council's Evaluation and Goals Committee in June 1965. These proposed guidelines included a search for a distinguished scientist to plan and organize the division. Problems would be selected, in consultation with the university atmospheric science community, to be worked on by research groups on short-term appointments. Areas from which problems would be chosen included:

- Possible modification of global circulation.
- Possible modification of the climate by deliberate or accidental means.
- Air conservation.
- Cloud physics and precipitation.
- Upper atmosphere and near-space modification.

The Evaluation and Goals Committee was favorable to the general philosophy of the applications division but was critical of the method of organization. The committee preferred to see such problems attacked on an ad hoc basis within the current NCAR organization rather than by the

creation of a new division. The attitude of the Executive Committee was more favorable and it was felt that the concept which the director was pursuing would minimize the potential problems involved in the new division. [6]

Another change in the organization of NCAR facilities was discussed at this time. At the September 1965 meeting of the Executive Committee, the NCAR staff proposed that the Field Observing Support Facility be converted to the status of an NCAR facility--that is, a joint-use facility. A number of universities were already being assisted on an ad hoc basis by the facility, and its resources were becoming fully committed. It was therefore deemed advisable to adopt a priority-setting mechanism such as the other NCAR facilities had. The mission of the facility was outlined as:

- To acquire, operate and maintain atmospheric observing, recording, and data processing devices beyond the capability of an individual scientist to acquire on a one-project basis.
- To develop reliable, standardized atmospheric observing instrumentation, recording, and data processing devices for use in the field.
- To provide technical assistance to university or other atmospheric scientists in the design and assembly of field projects.
- To assist members of the NCAR staff and university community in obtaining the use of necessary equipment and facilities from other agencies and groups.

The Executive Committee decided to refer the matter to the council or to one of its committees. The Evaluation and Goals Committee considered and approved the conversion of the facility at its December meeting. At the January 1966 Executive Committee meeting the director was authorized to establish an NCAR Field Observing Facility. Later in the year an NCAR Field Observing Facility Advisory Panel was named. Members were:

Ben Davidson, New York University  
Amos Eddy, University of Texas  
Tetsuya Fujita, University of Chicago

William E. Ohmstede, U.S. AEC  
Richard A. Schleusener, South Dakota School of  
Mines and Technology  
Robert W. Stewart, University of British Columbia

The other joint-use facilities, in particular the balloon facility, were at this time creating some unexpected budgetary problems. Outside users of the facilities were expected to pay for the supplies which they used; the major expense was in the balloons and helium used at the balloon facility. By 1965 NSF had determined that, under federal statute, NCAR must return all such funds received for supplies to the U.S. Treasury and that these funds had to come out of the final FY 1966 allocation of \$10.32 million.

The immediate steps taken in 1965 were to have NCAR stop acting as purchaser and supplier for users of the balloon facility. Instead, NCAR merely acted as an intermediary for the user scientist in the purchase of balloons and as an agent for the vendor of helium. This system was much less efficient and made much less use of the knowledge of the personnel of the balloon facility. While NSF would seek statutory relief for the situation from Congress in its budget request, it was felt that UCAR could act to provide immediate relief. At the January 1966 Executive Committee meeting the staff and the treasurer recommended that UCAR set up a revolving fund from which purchases of reimbursable equipment, supplies, and services could be made. At this meeting the treasurer was authorized to establish a UCAR Revolving Fund of \$100,000 which would be replenished by payment from users of NCAR facilities for actual costs of the equipment, supplies, services, and all other incidental expenses of the fund, including interest.

The whole facilities division, as well as part of the NCAR research program, was being studied and evaluated by the Council's Evaluation and Goals Committee at this time. The report of this committee, presented to the March 1966 Council of Members meeting, recommended:

- Development of strong scientific leadership in areas of a few of the crucial scientific problems.

- Development of procedures for providing deliberate, orderly, and continuing turnover of a substantial fraction of the research staff. Consideration should be given to creating a rank structure.
- A vigorous program of aeronomic studies should be initiated as a matter of high priority.
- NSF should be urged to divide support for the balloon facility between the Physics and Atmospheric Sciences sections of NSF.
- In future planning for use and development of facilities, special emphasis should be given to support of group projects addressed to the major research goals of the center.

Several controversial statements with regard to policy were also contained in the report, including the committee's belief that "NCAR's central objective should be major research achievements on the crucial scientific problems encountered in the atmosphere," [7] and that "the primary responsibility of the facility division is to support NCAR research scientists in their attack on crucial scientific problems." [8]

It was pointed out by the director and a number of the councilors that these statements represented a change in emphasis, if not in policy, from the original plan for NCAR. This plan had been that NCAR was to upgrade atmospheric research as a whole and to respond to the needs of the universities rather than to concentrate on its own research objectives. The committee members felt, however, that by setting high standards and by stimulation and participation of university scientists in joint programs with NCAR, that NCAR would most efficiently help the universities. They also pointed out that NCAR had been slow in developing programs which were beyond the capacity of individual universities.

The report was accepted by the council and forwarded to the Board of Trustees. The Board received the report at its next meeting (April 1966) and the various sections of the report were referred to the relevant Board committees and the NCAR staff.

At the 1966 council meeting the Council of Members was also able to elect its own officers for the first time. Those elected were:

Chairman: Robert G. Fleagle  
 Vice-Chairman: A. Richard Kassander Jr.  
 Secretary: Colin S. Ramage

Ruttenberg was appointed assistant secretary. New committee memberships were also adopted by the council:

Evaluation and Goals Committee (three-year rotation):  
 Norman A. Phillips (chairman), Ralph Bolgiano Jr.,  
 Richard M. Goody, Colin O. Hines, Owen M. Phillips,  
 A. C. Wiin-Nielsen, and Harold Zirin

Membership Committee (two-year rotation):  
 Charles L. Jordan (chairman), Shih-Kung Kao,  
 Herbert Riehl, and Zdenek Sekera

Trustees-at-Large (three-year rotation):  
 Paul Ebaugh, Homer T. Mantis, Robert A. Ragotzkie,  
 and Archie W. Straiton

Annual University Reports Committee (two-year rotation):  
 Keith Mather

At the same time a new study of the UCAR management structure was being undertaken. At the January 1966 meeting of the Executive Committee Chairman Kassander stated that it was generally recognized that the current structure of UCAR was transitional and that sufficient time had elapsed to consider the next step. He then announced the appointment of the ad hoc Committee on UCAR Management: P. E. Klopsteg (chairman), W. T. Golden, and A. T. Waterman. The task of the committee was "the examination of our past and present management arrangements, with a recommendation of a future arrangement that could accommodate unlimited (both in size and degree of participation) membership in the corporation, but with management in the hands of a group of a size which could be effective. Such an arrangement must give consideration to continuity of management, but satisfy the worry of some institutions that their support is asked without opportunity to participate regularly in management policy decisions." [9]

The problem of creating a management structure which could deal with a corporation of unlimited membership would be one of the committee's most difficult. The membership was steadily increasing; at its April 1966 meeting the Board elected the University of Denver and the University of Oklahoma as new members, bringing the total membership to twenty-three.

NCAR itself was, of course, still working with the universities as well as other national and international groups. In the summer of 1965 LAS organized a workshop on satellite meteorology, jointly sponsored by NCAR, NASA, and the U.S. Weather Bureau. The purposes of the workshop were to inform university scientists about up-to-date satellite data (the Tiros meteorological satellite series had been launched in 1960), and to stimulate university participation in further development of the national meteorological satellite program. Among the topics discussed were tropical storms and the general circulation of the atmosphere.

Next, in January 1966, LAS hosted a tropical meteorological planning session. The purpose of this meeting was to discuss the research opportunities that would arise when the Applications Technology Satellite (ATS)-B would be launched in the winter of 1966. It would be in a synchronous orbit over the Pacific Ocean. The participants in the planning session wanted to specify what kind of auxiliary observational programs (using ships, land stations, balloons, and aircraft) would be most useful to link with the satellite data.

This was actually the first in a series of meetings\* to plan a coordinated theoretical and experimental tropical meteorology program. By August 1966 a group was formed to work on the planning of the Tropical Meteorological Experiment (TROMEX), which was to be the first exercise formally associated with the internationally planned Global Atmospheric Research Program (GARP) scheduled for 1972 as a precursor to the World Weather Watch (see below).

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\*Later meetings were under the joint sponsorship of NCAR, NASA, NSF, and the Environmental Science Services Administration (ESSA).



The Line Islands Experiment (managed by NCAR), carried out from mid-February to mid-April 1967, was a pre-TROMEX experiment to provide necessary background material for the longer-range programs. This experiment consisted of a systematic program of surface, airborne, and satellite (ATS series) meteorological observations in the central equatorial region of the Pacific Ocean. Besides testing observing systems and the coordination of data, the experiment was designed to secure data on certain processes of the equatorial atmosphere which play vital roles in the general circulation of the atmosphere.

The concept of GARP grew out of two United Nations resolutions in 1961 and 1962 which urged international meteorological cooperation. In particular, the World Meteorological Organization (WMO) was requested to plan a program to strengthen meteorological services and research with particular emphasis on the use of meteorological satellites.

The WMO responded with plans for a World Weather Watch which would have three components--the Global Observational System, the Global Telecommunication System, and the Global Data Processing System. The International Council of Scientific Unions (ICSU), through the International Union of Geodesy and Geophysics (IUGG), took a second course of action which led to the formulation of an integrated program of research: the Global Atmospheric Research Program (GARP). Both programs converged in an agreement reached by WMO and ICSU in 1967.

The original plans for GARP had called for 1972 to be designated as a twelve-month period for an intensive, international, observational study, and analysis of the global circulation in the troposphere and lower stratosphere. It was later decided that 1972 was too optimistically early a date, but many preliminary studies, of which the Line Islands Experiment was one, were carried out in the 1960s. [10]

Technological developments such as GHOST (see above) were considered a necessity for any global meteorological observing system. The GHOST balloon test program (jointly sponsored by ESSA, the New Zealand Weather Service, and NCAR) flights began in March 1966. One hundred

flights were scheduled at 30, 200, and 500-mb.\* A year later, in order to allow Lally and his colleagues to devote full time to GHOST and other GARP-related objectives, a Global Atmospheric Measurements Program (GAMP) was set up within NCAR's Facilities division.

The Facilities division had actually been renamed the Facilities Laboratory in January 1966. The Facilities Laboratory, continuing under the direction of Rex, contained all of the NCAR joint-use facilities and a new Program on Applications Analysis. Certain of the in-house support functions, such as the library and technical supply activities, were transferred to the Administrative and Support Services division.\*\* The Applications Analysis Program would have a chief and a few project managers. Others working on projects in the program would be drawn from elsewhere in NCAR, or from outside, to work on specific projects.

In other areas of NCAR facilities, planning for the Inflation and Launch Shelter at the Palestine Balloon Facility had proceeded throughout 1965-1966. Engineering estimates placed the cost at somewhat over \$1 million and this amount had been approved by the Board in October 1966. However, when the bids came in late in 1966, the lowest was \$1.46 million. In view of budget stringencies and other NCAR priorities, the NCAR staff decided to reject all of the bids. In making this decision other designs of lower cost had been looked at but had been rejected. The Balloon Facility Advisory Panel had ratified the action. Part of the funds for the shelter would be used for other improvements at the Palestine, Texas, and Page, Arizona sites.

Budget restrictions were felt elsewhere in the Facilities Laboratory as well. The aviation facility found, in early 1966, that it

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\*In 1967 a then record-setting flight of 351 days (at the 200-mb level) was achieved.

\*\*In July 1966 the Design and Prototype Development Facility was created; it included the Machine Shop, the Mechanical Design Group, the Glass Shop, and an Electronics Shop.

would be unable to acquire a jet aircraft which had been planned for the summer of 1966. Because of this fact, and a growing need for more aircraft, the NCAR Aviation Facility Advisory Panel had advised the acquisition of a third Beech Queen Air 80 aircraft. The Board, at its April 1966 meeting, approved a five-year lease on a used aircraft.

The aviation facility had also instituted a summer training course for graduate students in 1966. The eight-week course was designed to acquaint students with the capabilities and limitations of aircraft as basic research tools in atmospheric science. The computing facility set up a similar program that summer which served as an introduction to the use of high-speed computers in atmospheric research.

UCAR and NCAR were carrying on other educational activities as well. The fellowship program was enabled to continue through the academic years 1965-1966 and 1966-1967 with a \$30,000 grant from the Max C. Fleischmann Foundation of Nevada, which was awarded in October 1964. In the Advanced Study Program there were five postdoctoral appointments for 1965-1966 and ten for 1966-1967. Regular series of spring and fall seminars were held each year.

While ASP was attaining its originally planned scope, LAS (with many individual research projects under way) continued to be concerned with the definition of its major goals. In 1967 two departments were created within LAS to aid in the evolution of major joint objectives. The Atmospheric Dynamics Department, headed by Thompson, emphasized the general circulation problem and the problem of cumulus convection. The Atmospheric Chemistry and Microphysics Department, under Richard D. Cadle, had as its major research areas the problem of the formation of precipitation in convective clouds and the problem of the large-scale transport of natural and artificial trace constituents of the atmosphere.

[11]

During this period HAO progressed along much the same lines as in previous years. Most effort went into the observation of the solar corona. In pursuit of this research objective, HAO eclipse expeditions

went to the South Pacific in 1965 and to South America in 1966.\* The former observations were to have been augmented by flights of Corona-scope II from the Palestine balloon facility. Unfortunately bad weather cancelled some of the flights in this program, although all of the on-site eclipse observations were quite successful.

Another long-term coronagraph project of HAO's was substantially altered in 1966 when NASA cancelled the AOSO project. Work on a satellite coronagraph for the AOSO had been proceeding since 1963 (see Chapter IV). NASA did, however, ask NCAR to submit a proposal for the completion of the coronagraph and its adaptation for flight on an Apollo manned spacecraft.

While maintaining several contracts from other government agencies such as the NASA satellite coronagraph one, HAO's operations had been under the main NSF contract since FY 1964. The original NSF contract with UCAR for the operation of NCAR expired on 31 May 1965. The old contract was extended throughout 1965 and into 1966 while NSF drafted a new one. The new contract was approved by the Executive Committee at its June 1966 meeting. The contract was again for a five-year period beginning on 1 July 1966. It was similar to the old contract except that it called for NSF approval of general procedures and policies more than of specific actions.

Another event of great importance to the life of NCAR occurred in 1966 with the completion of the Table Mesa laboratory.\*\* Due to budgetary considerations, the original plans for the building had to be severely cut back. This meant that the HAO staff remained in its quarters on the CU campus. The rest of the NCAR staff was moved into the new building during the fall of 1966. A formal dedication was planned for May 1967.

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\*On the 1966 Bolivia expedition, HAO provided logistic support for the Johns Hopkins University group.

\*\*The site had been annexed to the city of Boulder on 1 June 1965.

As events turned out, the dedication of the new building coincided with the first meetings of a reorganized UCAR management group. The ad hoc Committee on UCAR Management (appointed in January 1966, see above) made its first report to the Executive Committee in June 1966. A preliminary plan for a change in management structure was presented. The committee stated that it had taken as its objective the simple and democratic representation of all member universities together with a smooth and effective management. The major points of the plan were:

- An annual meeting of representatives of all member universities.
- The election of a Board of Trustees by this meeting.
- The Board would be composed of fifteen members (twelve from member institutions and three at large) elected for three-year terms on a rotating basis.
- The Board would meet four times a year to carry on the business of the corporation.
- A small executive committee, composed of the officers and one trustee-at-large, would meet when necessary to carry out business which could not await a Board meeting.

Discussion revealed feelings on the part of members of the Executive Committee that it might be better for each member institution to have two representatives at the annual meeting; the members' representatives meeting should have some other function as well, e.g., the election of new members; and the universities should have dominant representation on the Board--institutional trustees should be elected from among the members' representatives.

At the October Board meeting the committee presented its final report. It was a more detailed version of its earlier report incorporating suggestions which had been made about that report. The main features were:

1. There would be an annual corporate meeting at which each member would be represented by two corporate representatives designated by the chief executive officer of the member institution.

2. The business of the annual corporate meeting would be to: elect members of the Board of Trustees; appoint a nominating committee; appoint auditors; approve election or dismissal of members; pass on proposed assessments against the membership; perform other functions permitted by law, the certificate of incorporation, or the bylaws. (The Board amended this section to allow the annual corporate meeting to amend the bylaws of the corporation as well.)
3. The Board of Trustees would consist of fifteen members, twelve drawn from member institutions and three at large. (The Board added that the twelve institutional trustees would be elected from among the members' representatives.)
4. At each annual meeting four institutional trustees and one trustee-at-large would be elected. The term of office of the trustees would be three years.
5. The Board of Trustees would annually elect a chairman, vice-chairman, secretary, and treasurer. (The Board specified that all of the officers must be trustees.) The director of UCAR would be the principal executive officer of the corporation.
6. The Board of Trustees would meet at least four times a year.
7. The Executive Committee would consist of the officers and one trustee who was not an officer and would perform functions assigned by the bylaws.
8. All member institutions would be on the same basis of membership. The present council of members and Board of Trustees, as such, would be discontinued.

After considerable discussion and various amendments to the committee's report (some of which are indicated above), it was approved. The counsel was then instructed to prepare two sets of bylaws to be presented to the Board at a special meeting to be called in January 1967. One set of bylaws was to embody the recommendations of the ad hoc committee and the other to contain elements of a structure informally suggested at the meeting. The main differences in this second plan from that of the committee were that the Board of Trustees would have one member from each university plus trustees-at-large, and the current form of the Executive Committee would be retained.

The two plans were presented for consideration at the January 1967 meeting of the Board, as well as a third scheme. This third proposed structure for UCAR would return to the original form of UCAR's management except that each member institution would have one trustee instead of two. After much debate, the plan which embodied the ad hoc committee's recommendations was accepted.

Along with the bylaw changes to enact the new corporate structure, several technical changes were made to comply with a new Colorado law governing nonprofit corporations. One of these changes was to designate the chief executive officer as president of the corporation; that is, Director Roberts became president of UCAR and director of NCAR.

The last meeting of the old Board and the first meeting of the members' representatives was scheduled for May 1967, to be held just prior to the formal dedication of the new permanent NCAR laboratory. [12]

NOTES

1. The original councilors (all of whom were scientists) appointed to the Council of Members:
 

L. J. Battan	University of Arizona
Z. Sekera	University of California
G. W. Platzman	University of Chicago
W. E. Brittin	University of Colorado
H. G. Booker	Cornell University
C. L. Jordan	Florida State University
O. M. Phillips	Johns Hopkins University
N. A. Phillips	Massachusetts Institute of Technology
A. C. Wiin-Nielsen	University of Michigan
B. Davidson	New York University
P. Ebaugh	Pennsylvania State University
A. J. Pallmann	Saint Louis University
A. H. Thompson	Texas A&M University
R. G. Fleagle	University of Washington
R. A. Ragotzkie	University of Wisconsin
2. Minutes of the meeting of the Council of Members of UCAR, 8-9 March 1965, pp. 4-8.
3. Minutes of the meeting of the Executive Committee of UCAR, 11-12 January 1965, pp. 10-11.
4. Report of the Committee on Policies Governing NCAR Staff Relations with Universities, 12 October 1965. Appendix D of the minutes of the meeting of the Board of Trustees of UCAR, 12-13 October 1965, pp. 32-36.
5. Minutes of the meeting of the Board of Trustees of UCAR, 13-14 April 1965, p. 9.
6. Minutes of the meeting of the Executive Committee of UCAR, 29-30 June 1965, pp. 2-3.
7. Appraisal of the NCAR Program. Report to the UCAR Council of Members by the Committee on Evaluation and Goals, March 1966, p. 3.
8. Ibid., p. 10.
9. Minutes of the meeting of the Executive Committee of UCAR, 28 January 1966, p. 2.
10. An Introduction to GARP. GARP Publications Series No. 1, October 1969, Appendix I, pp. 15-18.



11. Annual Report - NCAR Research and Facilities Programs: 1967,  
pp. 53-54.
12. Minutes of the meeting of the Board of Trustees of UCAR,  
10-11 January 1967, pp. 4-11.





Table Mesa Laboratory of NCAR completed, 1967



## CHAPTER VI

INTERNATIONAL MEMBERS

The first annual meeting of members of UCAR following the reorganization was held on 9 May 1967. After passing a resolution confirming the act of the Board in January which changed the structure of the Board of Trustees, the main business of the meeting was the appointment of several committees. In discussion of the appointment of the Review Committee,\* the number of members of the committee was set at seven and the consensus was that the majority of the committee should be members' representatives. A slate was drawn up by Phillips (member of the former Evaluation and Goals Committee) and presented to the meeting. With no further nominations having been made, the following members were appointed by Chairman Kassander:

## Members' Representatives

A. K. Blackadar	Pennsylvania State University
**R. Bolgiano Jr.	Cornell University
R. R. Braham Jr.	University of Chicago
R. L. Chasson	University of Denver

## Others

J. T. Jefferies	University of Hawaii
**N. A. Phillips	Massachusetts Institute of Technology
**A. C. Wiin-Nielsen	University of Michigan

A Nominating Committee, proposed by the Nominating Committee of the Board, was elected: E. Lawrence Chalmers Jr., Verne C. Kennedy Jr., H. T. Mantis, K. B. Mather, and H. R. Byers. [1]

Immediately prior to the members' meeting, the old Board of Trustees held its last meeting in order to elect trustees to serve on the

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\*Although formally named the Review Committee, the old name of Evaluation and Goals Committee was used informally.

\*\*Member of former Evaluation and Goals Committee.

new Board. The new bylaws, adopted in January 1967, specified that the new Board should consist of the members of the old Executive Committee plus two more institutional trustees and two more trustees-at-large. The trustees elected (to serve until the indicated annual meeting of members):

Institutional Trustees

A. Ray Chamberlain, 1968  
Walter J. Saucier, 1969

Trustees-at-Large

Alan T. Waterman, 1969  
Earl G. Droessler, 1970

At the next meeting of the Board, in July 1967, President Roberts raised the question of separating the positions of president of UCAR and director of NCAR. Such a move would require a change in the bylaws to allow the two positions to be held by different people. The consensus of the Board was that separation of the two roles was a timely and appropriate step. A resolution was passed to bring the recommendation before the members of UCAR that the positions of president of UCAR and director of NCAR might be established as separate full-time positions.

At the request of the Board the president prepared and presented (at the October 1967 Board meeting) a detailed description of the two positions and the division of their responsibilities. In his memo, endorsed by the Board, Roberts set out the duties of the president as chief executive officer of the corporation. The president would see that the policies of the Board were carried out, as well as recommending policies; he would be responsible to the Board for the administration of all corporate affairs and activities. The director of NCAR would plan and direct NCAR's work and would formulate NCAR's policies; he would be responsible to the president of UCAR. [2]

The question was further considered at the special meeting of members in October 1967. In the course of the discussion it was suggested that the appointment of a "number-two" person within NCAR would

accomplish the same purpose as the separation of the offices. President Roberts replied that if he continued to hold both offices, he did not think he would be able to give NCAR the scientific leadership it needed, while the "number-two" person would not have sufficient authority and prestige to do so. The members' representatives then passed an amendment to the bylaws which removed the previous condition that the president of UCAR should also be the director of NCAR. [3]

One of the activities soon suggested for the president (in view of the fact that for three years building funds had been cut from NCAR's budget request) was the investigation of the possibilities of raising construction funds from sources other than direct federal appropriations. [4] President Roberts had already been successfully active in this area; in January 1967 he had submitted a proposal to the Max C. Fleischmann Foundation of Nevada for funds for the construction of a building for the Advanced Study Program. As a result, the Foundation made a grant of \$100,000 in the spring of 1967. Architectural planning for the new building, carried out by I. M. Pei and Associates, was completed in 1968. During the course of the planning it became clear that more funds would be required. By the time of the ground breaking in September 1968, the following funds had been obtained:

\$125,000	Fleischmann Foundation
\$ 25,000	UCAR Reserve Fund
\$ 25,000	El Pomar Foundation
\$ 2,800	Contractors involved in the construction

In 1968 NSF deeded one acre of ground to NCAR for the construction of the building. The government had the right of repurchase at any time and, after 25 years, UCAR would convey the land and all improvements to the government without charge. NSF, under its regular NCAR contract, would also fund all maintenance and costs of operation of the building. [5] The Fleischmann Building was completed and occupied by the Advanced Study Program in July 1969. The office of the president was also located there.

In other areas of expanded physical facilities and operations in 1967, the NCAR staff began to undertake a study of NCAR's needs for a supercomputer--one with 50 to 100 times the speed of the Control Data 6600. While the prospect of such a computer was still at least several years in the future, an immediate problem arose concerning the leasing of the 6600. Control Data Corporation announced early in 1967 that it would discontinue the educational discount which it had previously granted to NCAR and other eligible users. A staff study of the current and long-term usefulness of the Control Data 6600 concluded that the computer had given excellent service and was an extremely efficient general-use machine. It was felt that even if a supercomputer was acquired, there would still be a need for a general-use computer as well. Further, NCAR had a considerable investment in the supporting software and the hardware had an estimated life of at least ten more years. The staff, therefore, recommended that the purchase or lease-purchase of the computer would be the most economical way to have the use of it for the next five years. The Board and NSF both agreed with this conclusion and the computer was purchased on 1 May 1967. NSF provided \$2,465,000 in new funds; the remainder of the \$2,671,880.50 purchase price was reprogrammed from NCAR's FY 1967 budget. [6]

In 1967 the NCAR staff took over the operation of the Palestine balloon flight facility when the contract with Winzen Research, Inc., ended in October. The contract with Winzen to continue the necessary flight services was, however, continued. These services included the provision of two light planes, pilots, hangar, and all services for the aircraft.

At the same time the aviation facility was planning to acquire more aircraft. Contracts were approved in 1967 for the lease-purchase of a North American Aviation Sabreliner jet aircraft and for a Beechcraft 99 turboprop aircraft. Delivery on both aircraft was to be in 1968. Authorization for the purchase of the two aircraft was included in the FY 1968 budget request. The House removed this authorization, but the Senate authorized the outright purchase of the aircraft, since that course would be less expensive for the government in the long run.



This authorization to purchase remained in the appropriations bill when it emerged from the House-Senate conference. NSF increased NCAR's FY 1968 appropriation to cover part of the purchase price of the aircraft. The final FY 1968 allocation was \$11.8 million; \$2.075 million for the purchase of the aircraft and \$9.725 million for general NCAR purposes (the original FY 1968 budget request from NCAR had been for \$11.5 million, including the lease-purchase of the aircraft for that year). [7]

During this period from the fall of 1967 until the spring of 1968, NCAR was under an acting director (John Firor) while candidates for the post of permanent director were being considered. At its October 1967 meeting the Board authorized the chairman to appoint a Committee to Advise the President of UCAR Regarding Choice of a Director of NCAR. In November 1967 Chairman Kassander appointed the following members to the committee: H. R. Byers, B. Haurwitz, H. G. Houghton, Frederick Seitz (President of NAS), V. E. Suomi, and Robert M. White (Administrator of ESSA). Waterman was originally appointed to the committee, but following his death late in the year Seitz agreed to take his place. At the committee's first meeting in December 1967 Houghton was elected chairman. Part of the discussion at this meeting centered on the wisdom of appointing the director from within NCAR and on the question of the importance of the director being a meteorologist.

The committee stated in its report to the Board in May 1968 that while it had compiled a list of acceptable candidates, there was no unanimity for any one of them. The committee had thus decided that the principle of the executive responsibility of the president was overriding and that it was his function to select and recommend to the Board persons required to carry out the purposes of NCAR. [8] The president's nominee, Firor (who was included in the committee's list of candidates), was then appointed director of NCAR by the Board.\* The necessary NSF approval of the appointment came later in the month.

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\*Gordon A. Newkirk Jr. was appointed director of HAO (to succeed Firor) and associate director of NCAR in August 1968.

During 1967-1968 NCAR continued and accelerated its GARP-related activities. NCAR entered into a three-year program with NASA in 1967 for the design, development, and testing of components of a balloon-borne system for the Nimbus D IRLS (interrogation, recording, and location system) satellite experiment. NCAR's part of the project would be carried out by the GAMP (Global Atmospheric Measurements Program, see Chapter V) group and would involve the carrying out of the balloon flights in connection with the satellite flight, as well as the testing.

The Nimbus D IRLS experiment, a step in the development of a balloon-satellite system required for GARP, would involve 30 balloons flown from the central Pacific after the satellite was launched.\* The satellite system was designed so that the satellite could locate the balloons and receive atmospheric data from them to be transmitted to a ground station. Another GARP project being handled by GAMP was the GHOST program (see Chapter V). In 1968 a major portion of GAMP's activity was moved to the GHOST Flight Station in New Zealand in order to allow a more efficient interaction with the GHOST operational program and development effort.

The Barbados experiment in 1968 and the Barbados Oceanographic and Meteorological Experiment (BOMEX) in 1969 both involved several sections of NCAR. The latter experiment, planned to provide a pilot study for the planning and execution of GARP as well as to study the total fluid environment within a limited area, was organized by ESSA<sup>1</sup>. The former operation, spearheaded by Florida State University, was on a somewhat smaller scale and was tied in with the BOMEX pilot study in the summer of 1968. The aviation facility provided flight service for both experiments and the Field Observing Facility supported the Florida State program. Scientists from LAS and from various university and government laboratories participated in the two projects. NCAR scientists

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\*Nimbus D was launched in the spring of 1970. The IRLS experiment was initially successful and produced useful data for the first year until spacecraft yaw problems interfered. (*Compendium of Meteorological Satellites and Instrumentation*, NASA, 1973).

continued to be active in the planning of the Tropical Meteorology Experiment (TROMEX) which was begun by NCAR in 1966 (see Chapter V). A research plan for TROMEX was prepared by the TROMEX working groups and published by NCAR in March 1968.

While UCAR had always concerned itself with international meteorological matters (such as GARP), a new aspect of this concern appeared in 1968. The president asked the members' representatives in October 1968 for their comments on the possibility of admitting Canadian universities to UCAR (the question had been casually considered before, but the immediate concern grew out of an enquiry from the University of Toronto about membership). The consensus was that the president and the Board should proceed to investigate the matter carefully. [9] At its meeting in January 1969 the Board informally referred the matter to its Membership Committee.

Other new members were being elected to UCAR. At the special members' meeting in October 1967 the University of Maryland was elected. The University of Missouri, the Catholic University of America, and the University of Miami became members at the regular members' meeting in 1968. The first election of trustees by the members' representatives was also held at this 1968 members' meeting. From a slate of eight candidates offered by the Nominating Committee, the following institutional trustees (three-year terms) were elected:

A. Ray Chamberlain	Colorado State University
A. Richard Kassander Jr.	University of Arizona
Helmut E. Landsberg	University of Maryland
Gilbert L. Lee Jr.	University of Chicago

Two trustees-at-large were elected: W. T. Golden (three-year term) and T. F. Malone (one-year term to fill the vacancy left by the death of A. T. Waterman).

The Committee on Evaluation and Goals made its first full report to the members' representatives at the October 1968 meeting. This committee,\* which derived from the committee of the same name of the

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\*Members of the committee: R. Bolgiano Jr. (chairman), A. K. Blackadar, R. R. Braham Jr., R. L. Chasson, J. Jefferies, N. Phillips, and A. C. Wiin-Nielsen.

Council of Members, had been appointed at the members' meeting in May 1967 and had made a brief report at the October 1967 members' meeting. In that report the committee interpreted its role as dividing into two broad functions: (a) advisory to management--evaluation of specific programs of the various operating arms of the corporation; and (b) informative to the members' representatives--continuing review of the broad objectives of UCAR and of the extent to which these were being realized. In 1968 the committee reviewed one-third of each division (as two previous Evaluation and Goals Committees had done) and recommended that henceforth only one whole division be reviewed each year. Other recommendations of the committee were:

- Participation in GARP should emphasize NCAR's scientific, rather than its logistic, capabilities.
- All groups in NCAR needed to concern themselves more with the whole atmosphere and the overall meteorological aspects of their work. Synoptic meteorologists should be brought into some programs.
- The Facilities Laboratory should limit its development of measurement systems to responses to scientist-placed requests.
- Restructuring of HAO, both internally and as a component of NCAR-UCAR, needed immediate consideration.

The recommendations of the report were referred to the Board for its consideration and possible action. On the recommendation of Committee Chairman Bolgiano, it was decided that the Facilities Laboratory should be reviewed during the next year and that this fact should be considered in the selection of the new committee. In accordance with the procedure established the preceding year, Bolgiano (as outgoing committee chairman) nominated the members of the Evaluation and Goals Committee for the ensuing year. The members' representatives approved the following list of nominees (with the addition of Bolgiano, who was nominated from the floor): R. R. Braham Jr., R. L. Chasson, R. L. Clodius, A. W. Straiton, Michael Garstang, Robert C. Haymes, and Mariano A. Estoque. [10]

The Board, at its annual meeting in October 1968, held its (now annual) election of officers:

Chairman:	J. C. Calhoun Jr.
Vice-Chairman:	E. G. Droessler
Secretary:	S. L. Hess
Treasurer:	T. R. Rogers
Member of the Executive Committee:	C. F. Floe

Ruttenberg and Wolff were appointed assistant secretaries, and Roecker was appointed assistant treasurer.

The budget was also considered at this Board meeting. NSF had imposed an expenditure limit of \$10.45 million for FY 1969 (NCAR's budget request for FY 1969 had been for \$11.4 million). The FY 1970 request of \$14.3 million had been submitted to the Bureau of the Budget. The main new item in the FY 1970 budget was approximately \$2.65 million for one year's rental of a Control Data 7600 computer and the subsequent buildup of the computer facility. However, in December 1968 NSF requested NCAR to submit a FY 1970 budget for \$11.1 million. This meant that rental of the 7600 computer and all new construction plans had to be dropped.\*

One item of construction for which funds were provided in 1969 was a hangar at the Jefferson County Airport. The need for a hangar had arisen when NSF acquired in April 1968 a surplus DeHavilland Buffalo aircraft from NASA for assignment to NCAR. The problem in hangaring the plane proceeded from the fact that the airport had no hangar which could accommodate its height. While one of the existing hangars could have been expanded to house the aircraft, it was considered more satisfactory and, in the long run, more economical for NCAR to construct its own hangar. In the spring of 1969 NSF agreed to provide funds for the construction. NSF would lease the land for the hangar facility from

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\*The subsequent shortage of space led NCAR to once more lease space in the University of Colorado's Physical Sciences Research Building No. 2 in 1969 for elements of the Facilities Laboratory and HAO.

Jefferson County on a ten-year basis with renewal options. Construction was under way in the spring of 1970 and was completed by December of that year.

The DeHavilland Buffalo aircraft took the place of the Beech 99 aircraft which NCAR had planned to acquire in the spring of 1968. NCAR did take delivery on a North American Rockwell Sabreliner turbojet aircraft in October 1968. These acquisitions were overshadowed by the loss of NCAR's Queen Air N303D aircraft over Lake Superior on 23 October 1968; it was on a routine research mission for the University of Wisconsin. Lost with the plane were Robert C. Carew, NCAR pilot; Gordon E. Jones, Combs Aircraft, Inc., copilot; and V. Krishna Menon, University of Wisconsin scientific observer. A careful study was made seeking possible causes for the accident. As far as is known, the plane was fully functional and was being operated within proper procedures at the time of its loss. No wreckage from the aircraft was found on the lake bottom despite an extensive search carried out during the summer of 1969. The trustees agreed with the director that it was not practicable to search further to discover the cause of the accident. [11] The Board authorized purchase of a replacement for the lost aircraft at its January 1969 meeting. A Queen Air N304D aircraft was in service in the summer of 1969.

The aviation facility and all other sections of the Facilities Laboratory (FAL) were reviewed by the Evaluation and Goals Committee for their 1968-1969 research review. In its report to the annual (October) 1969 members' meeting the committee stated that it had found the operational and logistic capabilities of FAL to be excellent. The committee did, however, criticize a weakness in long-range planning, failure to use the advisory panels effectively, and insufficient emphasis on research and development functions.

The Evaluation and Goals Committee also made recommendations for its future activities. The heart of these recommendations was that the committee should concern itself with the evaluation of the goals and accomplishments of NCAR and UCAR, and that its advisory functions be

transferred to advisers and consultants named by the director in consultation with the Evaluation and Goals Committee. When the new committee was appointed at this meeting, it was given the charge to act as a steering committee to assist the president in arriving at a long-range plan for UCAR.\*

The president had already presented plans at the May 1969 Board meeting for the preparation of a "Blue Book II," which would outline the aims of NCAR for the next decade. This document would identify the important problems facing the atmospheric sciences in the next ten years, and would prescribe the optimum role for NCAR in attacking those problems. Other questions would also be approached, such as the proper mission of NCAR's Facilities Laboratory and NCAR's role in education-related activities, in applied research, and in national and international planning efforts. The president felt that it was important that the initiative for the document come from within NCAR, but with full scrutiny by UCAR and the scientific community. [12]

A long-term project for the 1970s with which NCAR was already involved was the National Hail Research Experiment (NHRE). NCAR had participated in joint hail studies before: Project Hailswath in 1966 and the Joint Hail Research Project in 1968-1970. The latter study was conducted jointly by NCAR, ESSA (later NOAA), and Colorado State University in northeast Colorado under the sponsorship of NSF.

The plans for NHRE itself began in May 1965 when the Interdepartmental Committee for Atmospheric Science (ICAS) recommended to the Federal Council for Science and Technology that NSF should develop a plan for hail suppression research. NSF then formed the Hail Suppression Research Steering Committee (Suomi, chairman) which prepared the "Outline of a Hail Suppression Test" (1968). After reviewing this

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\*Members of the new Evaluation and Goals Committee who had served on the 1969 committee--R. L. Clodius, M. Garstang, and A. W. Straiton, who had not served previously--Edward S. Epstein, T. F. Malone, K. B. Mather, and David Atlas.

report, ICAS requested NSF to arrange operational plans for a major, integrated field experiment on hailstorms. In December 1968 NSF asked NCAR to prepare a plan for such an experiment.

NCAR organized a Select Planning Group, including experts from NCAR and other institutions, which produced the "Plan for the Northeast Colorado Hail Experiment" (NECHE). The plan was submitted to ICAS and endorsed by that body in April 1969. ICAS then asked NSF to designate management responsibility for the project. In September 1969 NCAR was requested by NSF to manage the (now renamed) National Hail Research Experiment.

The two major objectives of the project were: (1) to gain an increased understanding, by observation and analysis, of all aspects of the cloud dynamics and microphysics governing the severe convective storms that produce damaging hailfall at the ground; and (2) equipped with this increased knowledge, to develop, if possible, a practicable method for suppressing the occurrence of damaging hail.

The first full season of the planned five years of the project would be 1972, with field tests being carried out in 1971. Funding through 1972, at which time a review of the project would take place, was not to exceed \$4.7 million. NHRE would be a collaborative project coordinated by NCAR. The various groups participating by 1970 were from the University of Chicago, Colorado State University, the Desert Research Institute, South Dakota School of Mines and Technology, the University of Wyoming, and the Illinois State Water Survey. When NCAR took over the management of the project in 1969, William C. Swinbank (in ASP at that time) was appointed its director. [13]

NCAR included a \$1.7 million item for NHRE (still NECHE at that time) in its budget request for FY 1971. The total budget request, approved by the Committee on NCAR Budget and Program of the Board, totaled \$30.6 million for FY 1971. Besides the NHRE item, this amount included \$15 million for capital equipment purchases for HAO and LAS and construction of the south tower and east building. Another major item was the rental of a Control Data 7600 computer. The budget



submitted by NSF to Congress later in 1969 came to \$15.2 million for NCAR. This amount was an increase over the FY 1970 budget and it was felt that it would allow the rental of the computer and construction planning. The subcontract for the computer's rental was authorized in May 1970 and the computer was installed a year later.

Funds were also being sought from non-governmental agencies for the UCAR fellowship program. In the fall of 1968 the fellowship fund received a gift of \$7500 (over a three-year period) from the Public Service Company of Colorado and \$500 from IBM. Since this was still not a sufficient amount, the Board transferred \$15,000 from the UCAR reserve fund to the fellowship fund in January 1970 to support the program for the academic year 1970-1971.

In other educational activities, the aviation facility and the computing facility continued their summer training programs for students in the atmospheric sciences. Besides its core program of post-doctoral appointments, ASP had, since 1966, held summer colloquia on specific topics of fundamental interest in atmospheric science. These colloquia, at which invited senior scientists lectured, were set up to include a number of graduate student participants as well.

Several of the summer colloquia of ASP were jointly sponsored by the astro-geophysics department of the University of Colorado and by HAO. The formal connection between HAO and the university had been terminated several years earlier (see Chapter IV) and HAO continued to devote itself largely to solar research. By 1967 the HAO staff was considering a move from the Climax site due to the emerging practicality of operating at sites with superior weather and visibility conditions. The Program on Applications Analysis undertook site surveys in Hawaii, Chile, Baja California, and Arizona during 1968. The sites were tested for their suitability for a solar-coronal observatory, as well as for a solar observatory. In 1969-1970 HAO surveyed a possible site on Grand Mesa in Western Colorado.\* The conditions there were

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\*The Program on Applications Analysis was terminated in 1969.

found to be parallel to those at Climax. By 1970 budget conditions had forced the conclusion that funds would not be available to move the observatory in any case. During 1970-1971 the HAO staff, after much consideration, decided to close the Climax station permanently. Some of the instruments were moved to other sites, in particular to the Sacramento Peak Observatory where a joint observing program was established with HAO. Climax was officially closed on 30 June 1972.

Despite the phasing out of observing activity at Climax, research activity at HAO continued at a high level. Much effort in 1969 was devoted to preparation for the March 1970 solar eclipse. An HAO expedition went to Mexico to observe and to perform a number of experiments during the course of this eclipse. Some of the other areas of research at HAO during 1969-1970 were studies of the circulation of matter in the solar interior, a study of the magnetic field of the corona, and studies of several areas of solar-terrestrial physics.

In LAS research also progressed along the same lines in 1969-1970 as in the immediately preceding years. Budget considerations forbade the initiation of any major new programs. The Atmospheric Chemistry and Microphysics Department had as one of their major goals the achievement of a better understanding of processes leading to precipitation in convective clouds. A major part of the atmospheric chemical research related directly or indirectly to the problems of air pollution. Research in the Atmospheric Dynamics Department covered a full range of the scales of motion found in the atmosphere and oceans. The General Circulation Model (GCM) continued to be a major project. [14]

The GCM, which had been under development by Akira Kasahara and Warren Washington at NCAR since 1964, had by 1970 become an important research tool in the design of observing systems for GARP. In particular, the program could be used to answer questions about how predictions of the behavior of the atmosphere depended on the kind, resolution, and accuracy of meteorological field observations. [15]

NCAR had been closely involved with various phases of GARP planning since the TROMEX planning sessions beginning in 1966 (see

Chapter V). Plans for a tropical meteorological experiment in the western Pacific area had been approved (as part of the GARP tropical subprogramme) by the Study Conference on GARP (a scientific planning meeting) held in Stockholm in 1967. At the official governmental planning conference\* held at Brussels in 1970, practical considerations caused the locale of the experiment to be changed to the Atlantic; the concept of TROMEX thus became the GARP Tropical Experiment in the Atlantic (GATE).

Another GARP-related tropical experiment planned by NCAR and NASA was the Tropical Wind Measurement Experiment for Nimbus F. This experiment, as originally set out in the plans formulated in 1968-1969, was to measure equatorial wind velocities in the upper troposphere and lower stratosphere by differential Doppler techniques, using the Nimbus F satellite (scheduled for launch in 1974) and constant-level balloons. In 1970 the plans for the experiment were expanded and it was renamed TWERLE (Tropical Wind, Energy Conversion, and Reference Level Experiment). The techniques and objectives of this experiment were the same as before except that more equipment was added to provide a GARP reference level capability for the southern hemisphere and to obtain direct measurements of atmospheric energy conversion. [16]

UCAR, as well as NCAR, maintained an interest in the progress of GARP. An expression of this interest was formalized in 1971 with the creation of the UCAR GARP Council, composed of one scientist with an active interest in GARP from each of UCAR's member universities. The council was planned as a two-way communication channel with the universities concerning GARP activities.

During 1969, however, UCAR had to devote much of its time to the consideration of its membership policies. Two problems were under discussion at this time; the first dealt with multiple-campus members and the second with non-U.S. members. The question of multiple campuses

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\*In preparation for this meeting, some 300 scientists met in Boulder in October 1969 to discuss United States participation in GARP.

was largely a technical matter and the formula which the Membership Committee proposed to the Board in August 1969 was approved without change. This UCAR policy on multiple campuses was, upon the approval of the members at their 1969 annual meeting, that:

- Only a legal person, such as a university, could be a member.
- The member might designate one or more of its autonomous campuses to be carried on the roster of membership, with the approval of the Board and members.
- Each such campus must pay the initial membership fee or any assessments as an individual member.
- Each multiple member might have two members' representatives from each campus which may vote as regular members' representatives.
- For a vote by members (e.g., to amend the bylaws), each member shall have two votes regardless of the number of its members' representatives.

The matter of membership for non-U.S. universities was somewhat more contentious. The question was first formally raised by the president at the annual members' meeting in 1968 (see above). The Membership Committee recommended to the Board in May 1969 that non-U.S. universities be admitted to UCAR on the same basis as American universities, but without voting rights. During the discussions by the Board, following presentation of this report, it was pointed out that full voting membership for non-U.S. universities might not meet with National Science Board approval and that some non-U.S. members might prefer non-voting membership. The committee was asked to study the matter further with corporate counsel and to report back to the Board. [17]

The next report of the Membership Committee to the August 1969 meeting of the Board offered three possible alternatives for membership for non-U.S. universities:

- Full voting membership in UCAR.
- Non-voting membership with all other considerations the same.

- A special category of International Membership, with the initiative for invitation and election resting with UCAR.

The committee recommended the third alternative. They also suggested that if the first alternative were adopted, the Board modify its membership policy so that membership would be by invitation only. After discussion, the third alternative of the report was adopted and the necessary changes in the bylaws were recommended for adoption by the members. [18]

The amendments to the bylaws establishing international members were adopted by the members at the 1969 annual meeting. These members were to be universities elected to membership in the same manner as other members; they would not be charged an entrance fee or any assessment. The chief executive officer of an international member might appoint a scientific and an administrative representative who would be invited to all meetings of members and members' representatives. They would be able to participate in all deliberations and discussions but would not be entitled to vote. [19]

The University of Toronto was elected as the first international member at the annual members' meeting in October 1970.

NOTES

1. Minutes of the Annual Meeting of Members of UCAR, 9 May 1967. The members and their representatives at this time were:

## University of Alaska

Keith B. Mather  
Kenneth M. Rae

## University of Arizona

A. Richard Kassander Jr.  
David L. Patrick

## University of California

Orvin W. Campbell  
Morris Neiburger

## University of Chicago

Roscoe R. Braham Jr.  
Gilbert L. Lee Jr.

## Colorado State University

J. E. Cermak  
A. Ray Chamberlain

## University of Colorado

Wesley E. Brittin  
Thurston E. Manning

## Cornell University

Ralph Bolgiano Jr.  
Thomas R. Rogers

## University of Denver

Robert L. Chasson  
Shirley A. Johnson

## Florida State University

E. Laurence Chalmers Jr.  
Seymour L. Hess

## University of Hawaii

Wytze Gorter  
Colin Ramage

## Johns Hopkins University

Owen M. Phillips  
Benjamin G. Willis

## Massachusetts Institute of Technology

Carl F. Floe  
Henry G. Houghton

University of Michigan  
 E. Wendell Hewson  
 A. G. Norman

University of Minnesota  
 Homer T. Mantis  
 Frank Verbrugge

New York University  
 James E. Miller  
 (only one representative appointed  
 at that time)

University of Oklahoma  
 Verne C. Kennedy  
 Walter J. Saucier

Pennsylvania State University  
 Alfred K. Blackadar  
 E. F. Osborn

Saint Louis University  
 Edward J. Hellman  
 Albert J. Pallmann

Texas A&M University  
 Horace R. Byers  
 John C. Calhoun Jr.

University of Texas  
 Norman Hackerman  
 Archie W. Straiton

University of Utah  
 Shih-Kung Kao  
 William S. Partridge

University of Washington  
 Robert G. Fleagle  
 Joseph L. McCarthy

University of Wisconsin  
 Robert L. Clodius  
 Eberhard Wahl

2. Meeting materials, meeting of the Board of Trustees of UCAR, 17-18 October 1967, Appendix D.
3. Minutes of the Special Meeting of Members of UCAR, 17-18 October 1967, pp. 5-8.
4. Minutes of the meeting of the Board of Trustees of UCAR, 4 January 1968, p. 4.
5. Minutes of the meeting of the Board of Trustees of UCAR, 9-10 May 1968, p. 7.

6. Minutes of the meeting of the Executive Committee of UCAR, 10-11 April 1967, pp. 8-9. Minutes of the meeting of the Board of Trustees of UCAR, 11-12 July 1967, p. 7.
7. Minutes of the meeting of the Board of Trustees of UCAR, 17 October 1967, pp. 9-10. Meeting materials (Agenda) of the meeting of the Board of Trustees of UCAR, 17 October 1967, pp. 6-7. Meeting materials (Agenda) of the meeting of the Board of Trustees of UCAR, 4 January 1968, p. 4.
8. Letter from H. G. Houghton, Chairman of the Committee to Advise the President of UCAR Regarding Choice of a Director of NCAR, to W. O. Roberts, President of UCAR, 18 March 1968, in meeting materials of the meeting of the Board of Trustees of UCAR, 9-10 May 1968, Appendix D.
9. Minutes of the meeting of members of UCAR, 8-9 October 1968, p. 10.
10. Ibid., pp. 13-15. Ibid., Appendix D, pp. 35-49.
11. Minutes of the meeting of the Board of Trustees of UCAR, 15 October 1969, p. 8.
12. Minutes of the meeting of the Board of Trustees of UCAR, 7-8 May 1969, p. 7.
13. National Hail Research Experiment Program Plan 1972-1976, NCAR, March 1973, pp. 1-3. Annual Report - NCAR Research and Facilities Programs: 1970, pp. 65-67.
14. Annual Report - NCAR Research and Facilities Programs: 1969, passim.
15. Annual Report - NCAR Research and Facilities Programs: 1970, p. 73.
16. A Tropical Wind, Energy Conversion and Reference Level Experiment. NCAR, University of Wisconsin, and Goddard Space Flight Center, October 1970.
17. Minutes of the meeting of the Board of Trustees of UCAR, 7-8 May 1969, pp. 5-6; Appendix C.
18. Minutes of the meeting of the Board of Trustees of UCAR, 6-7 August 1969, pp. 5-6; Appendix B.
19. Minutes of the annual meeting of members, 14-15 October 1969, pp. 9-10.



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