THE DEPARTMENT OF ATMOSPHERIC SCIENCE AT CSU

a 20-year perspective

by Department Faculty Members

1982

THE DEPARTMENT OF ATMOSPHERIC SCIENCE AT COLORADO STATE UNIVERSITY

A 20-YEAR PERSPECTIVE

ABSTRACT

The CSU Department of Atmospheric Science was founded in 1962. It now has a faculty of 13 (full time), a student body of over 70 graduate students and an additional research associate and supporting staff of about 60.

As part of the 20th year reunion celebration of our Department on 6-8 July 1982 we have taken this occasion to issue this brief report on how our Department has grown and developed through these 20 years. Rather than having one or two people sit-down and write this report by themselves, we have decided to have a number of our current faculty members and Herbert Riehl tell the story of our Department's development in their own unedited words. A wide range of points of view are brought forth, although admittedly from the faculty point-of-view. We recognize that a similar report from our former and present graduate students, staff, and research associates might give a somewhat different perspective. But it is the faculty that have been here the longest and seen our Department evolve the most.

The older faculty have primarily concentrated on our Department's development during the 1960's while the younger faculty the developments during the 1970's. This report also lists background statistical information on who has been a member of our faculty, our graduates with their degree thesis titles, and also other information on our Department's current research associates, and support staff.

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HERBERT RIEHL, LEWIS GRANT, ELMAR REITER

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1. EARLY DEVELOPMENT OF THE DEPARTMENT OF ATMOSPHERIC SCIENCE AT CSU

by

Herbert Riehl

1. The Beginnings

A very large number of meteorologists were trained between 1939 and 1945. Although their employment was mainly expected to be war duty, the few universities then processing the bulk of the trainees insisted on enlarged general education, such as mathematics and hydrodynamics, to supplement the courses suited for immediate application. Thus, at the end of 1945, there was a broad core of highly trained professionals with subsequent experience. Many of those went into other fields or returned to previous occupations. But a large fraction remained and took advantage of government-sponsored advanced training programs at universities leading to higher degrees.

While there was a distinct slump in meteorology in the late 1940's lasting well into the 1950's, there was on the other hand the first development of private meteorology, a wide expansion of airline forecasting opportunities with the upsurge of air travel and weather modification experiments and, very soon, the application of computer technology to weather forecasting problems. These stimuli, to name but a sample, were enough to provide a new impetus to the field. Under favorable circumstances, where the contribution of Sputnik I may not be forgotten, new departments of meteorology came into existence. Job opportunities grew with the number of graduates. The name 'meteorology' gradually became replaced by 'atmospheric science', denoting a field much wider than forecasting tomorrow's weather.

In Colorado, the origin of Atmospheric Science was rather different. It began via the High Altitude Observatory, then located at Climax with offices on the Boulder campus of the University of Colorado. The director, Dr. Walter Orr Roberts, had developed a considerable interest in solar-weather relationships. These he discussed with me when, in the summer of 1950, I dropped in on him after a mountain vacation not even knowing beforehand about him or his organization's existence. The result was an invitation to spend the summer of 1955 in Boulder, where I gave a course in meteorology on the High Altitude Observatory premises, the first such course given in Colorado as far as I know. For practical application we tried forecasting on the sun at the Bureau of Standards with the principle of one-day extrapolation, where the 'day' here is 27 earth days. These forecasts were only partially successful. I also paid a first visit to what later became Colorado State University. We were impressed by the nice, small college town with wide tree-lined streets.

I had a summer repeat engagement at the High Altitude Observatory in 1957, when I tried out my skills at solar-weather relations, and a shorter stay there in 1958. There were longer visits to Fort Collins,

where I principally met Dr. Maurice Albertson, the principal power behind the Hydraulics Laboratory, Dr. J. E. Cermak who had his first wind tunnels along with the hydraulic lab next to the engineering building on the campus, and Dr. R. A. Chamberlain who had become the first Ph.D. to graduate from the institution and was advancing in the management of the Civil Engineering Department. In the late 1950's interest began to run high in these circles about weather modification in Colorado -- improvement of the winter snow pack and hail abatement in summer. Of particular interest and relevance was Cermak's modeling of Long's Peak and the eddies created downstream. About that time Dr. Dave Fultz and I published some results from a general circulation experiment which we analyzed from data provided with great effort by his laboratory at the University of Chicago.

The combination of the laboratory work plus knowing me, coupled with the evident general upswing of atmospheric science, presumably were the motivation for first inquiries whether I would care to establish an atmospheric science sub-program within the Civil Engineering Department. Dr. Chamberlain, now Assistant Dean for Engineering, first sent an offer in October 1959. The President, Dr. William F. Morgan and the Dean of Faculties, Dr. Andrew Clark, visited me subsequently in Chicago. As an upshot of these and other negotiations I accepted their offer (the salary partly in mountain scenery) with this understanding:

1) I shall have an appointment as Professor and Program Director of Meteorology in the College of Engineering.

2) Initially, the meteorological activity will be in the Civil Engineering Department.

3) I shall have responsibility for the meteorological research program. New research, or continuation of current research in meteorology, will only be taken at my initiative or concurrence.

4) I shall have responsibility for developing a meteorological instruction program of the type previously discussed with Dean Chamberlain, both on the graduate and undergraduate levels.

My family and I arrived in Fort Collins from Chicago in late June, 1960; at that time only the program of Dr. Richard Schleusener and Mr. Lewis O. Grant in hail modification was ongoing. I already had a summer commitment for the hurricane season in Miami of long standing. After a brief stay in Fort Collins I went to Miami where the severe hurricane Donna of early September was the main feature with quite a few aircraft missions in which I took part. My permanent work in Fort Collins began during the autumn quarter -- the institution then was on the quarter system.

2. Development of Faculty

At the beginning there was the question which direction the new program should take. It was clear that an instruction program had to be

developed so that graduates with a broad foundation and wide marketability would emerge. Yet, there was the conflicting question of specialization in terms of student and academic interest. Clearly, one could not develop all facets of the atmospheric science subject at the highest level -- that time was one generation past -- so one should aim for the forward cutting edge of research (and development) in a limited number of subjects only. These would be determined by the peculiarities of the university's position in the state picture, especially its land-grant status; the predilections of the faculty to be chosen; and, third and very important, proposed research had to be attractive to a wide backing by outside, especially federal, interests. Limited state funds have been made available mainly to the weather modification program. Private support was very limited due to the public nature of the institution; one recalls with pleasure, however, the contribution by a Denver foundation to the start of air pollution studies, and the support of the Link Foundation over several years.

For my immediate associate, I thought at once of Dr. Elmar Reiter at Innsbruck, Austria, with whom I was associated in various jet stream studies and Navy-executed flight programs in the 1950's at the University of Chicago, who was very energetic, enthusiastic and with broad-based knowledge. In theory, Ferdinand Baer had just graduated with Professor G. Platzman at the University of Chicago. In spite of these leanings Baer had always retained a practical interest, participated in several field programs and thus seemed an excellent man to start dynamic meteorology with applications. Because of its location the program should have an intensive concern with climatology, hydrometeorology, forestry, and agriculture. Potential staff members with inclinations in these directions were few. But, at Rutgers, William Marlatt was a new graduate actually in soils, but doing much of his work, especially the climatic part, under the guidance of my friend the well known Professor Erwin Biel. Together with Mr. Grant and Dr. Schleusener, civil engineering already present, the administration indicated that this was about enough for a new starting faculty. They all accepted and had arrived by the early autumn of 1961.

From the first, research support on the federal level was very positive, and in the beginning the state contribution to starting the program was particularly large. Support was found for a variety of programs, including this writer's research in tropical meteorology, thought by many to be as out of the way there as it was at Chicago. But the program has continued to flourish, later taken over by Dr. William M. Gray, showing that one need not live in the tropics to do good tropical meteorology. The idea of a hydrodynamics laboratory, however, never came off. Funding for rotating tank installations with their great cost was not forthcoming with enthusiasm because of the rapid rise of computer modeling which many thought better than the physical water modelling -- rightly or wrongly. For non-rotating problems, collaboration in Dr. Cermak's wind tunnel lab was entirely satisfactory. Further, nothing came of work on the western mountain and forest meteorology, except for the snowmaking. Disappointing in particular was the lack of support for forest fire studies to this writer. These things happen, however, and must be taken in stride. The direction which is taken in the end is guided in large measure by what is

feasible. Dr. Marlatt turned his attention to radiation and ground truth experiments for the newly invented satellites, initiating a drift of the group's research more toward the general research problems of then and now rather than locally bound ones, all quite evidently to the benefit of progress of the initial civil engineering group.

3. M.S. Degree Program

A marked feeling developed about the middle of 1961, during arrival of all the new staff, that the meteorology program should quickly begin to attract students, partly on the basis of student inquiries, and that limited instruction should be started in the autumn quarter of 1961. It was understood from the beginning that we hoped to establish M.S. and Ph.D. programs. The question had to be settled whether there should also be an offering leading to the B.S. degree. This though was fully opposed by myself and, as far as I recall, advocated by no one. Employment opportunities for a B.S. in atmospheric science, in contrast to civil engineering, were and are very limited. It appeared much better to require a B.S. in physics, mathematics or engineering (B- average required for graduate school) rather than have the meteorology M.S. students sent to supplementary mathematics and physics classes. Although one or two undergraduate service courses for the university students at large and in related fields were instituted later, the start of the core problem as M.S. study appeared to be very successful then and, in retrospect was successful and well justified.

Thus, it was easy to prepare a curriculum, as addendum to the civil engineering curriculum, and have it passed quickly by the requisite university machinery. The model was largely the University of Chicago curriculum, itself not very original, with main emphasis on dynamics, thermodynamics, physical meteorology, climatology and some general circulation and tropical meteorology available early. The big synoptic laboratory of the 1940's had been cut by Chicago and other institutions already in the 1950's under the impact of computer forecasting and then also computer plotting and analysis. We felt laboratory work indispensable, but attached it to the individual courses as exercise and practical learning sessions. A limited synoptic laboratory was also retained with specific questions for quantitative solution. Map discussion, from facs transmissions, was held daily generally with a large attendance, allowing students (and faculty) to understand the changes and processes taking place in the atmosphere without going through the detail of plotting and analyzing all data personally. With the increasing scope of charts to hemispheric and global scale, this would have been impossible anyway. The time gained could be placed on detailed examination of local forecasting and phenomena; many such studies were undertaken.

The advertisement for the new courses could not go out until the 1962 catalogue of the institution. At the beginning only three students were registered, of which two flunked out in the first dynamics course. The remaining one, James L. Rasmussen, had the unique experience of being a single student with six faculty members to look after him, rather the reverse from the normal situation! In the subsequent years

ratios changed toward the more customary ones. But the early spurt generally gave a good feeling of cohesion to the whole group that was to develop rapidly thereafter from a program to a department.

4. Establishment of Department

In the spring of 1962, almost two years after the start of activity, the program had grown considerably in research volume, about 1 million dollars per year. A large number of technicians were employed on projects and many instruments and facilities were being acquired. Mr. William M. Green was hired to be in charge of all facilities and instrumentations as well as the subprofessional personnel. Mr. John Vetter took on the supervision of accounting, a large job of many facets. The large budget, a substantial fraction of the total civil engineering research budget, the new student body (hoped for) with a study plan rather different from the engineering curriculum, plus the entrance of new faculty members none of whom was a registered engineer, increasingly made the atmospheric science program a somewhat foreign body under the civil engineering wing. The opinion gained ground that the program had as much to offer in its own right as many departments at the institution; therewith a train of thought was set in motion in the administration and throughout the engineering college to create a fifth Department in the College of Engineering. This matter bore fruit, and we are here together on its 20th anniversary. I rather doubt that anyone is left today who doubts the wisdom of this step.

The creation of the Department took place only some months before all civil engineering research had been moved from the main campus to the foothills research campus. The entire atmospheric science faculty had participated in this move. Only one office was left for the faculty on the campus, later abandoned; and a single office with secretary's room for the department head. I kept this office throughout my term as department head where I spent about half-time on matters of administration and contacts with the university administration, other colleges and various committees. It appeared to be crucial to retain a presence on the main campus and not be 'out of sight' at the foothills.

5. Facilities

While various facilities were provided by individual projects and some by the state of Colorado, special mention is due to a large facilities grant made by the National Science Foundation to Mr. Lewis O. Grant consisting of an entire mobile laboratory. This laboratory, which permitted off-campus operations for whole seasons, was mainly employed for winter snowmaking experiments at Climax, Colorado, at an elevation of about 11,000 feet (3400 m). The results from the operations then began to continue to be a subject of discussion in the literature.

6. Ph.D. Degree

In the autumn of 1962 a considerable number of M.S. students enrolled in the program and this growth continued subsequently. Most students had graduate assistantships then paying $200/month during the academic year for half-time work, and full time during the summer. The institution collaborated through remission of tuition. The true value of the assistantships was competitive in the country and its economic value probably was at least equal to that of the inflated sums paid today.

The M.S. program was gradually expanded also by students sent by government agencies, the military, the United Nations and foreign countries. Given full time study, the M.S. could be obtained in four quarters, for students with assistantship in two years. At any rate, the time was short enough so that many students soon began inquiring into possibilities for a doctorate. We did not want to lose our good students and the Ph.D. really had been a prime objective of the program from the beginning. Thus deliberations started in 1963 and formal application made to the university in early 1964.

The instruction program on the graduate level was more than doubled by the expansion to the doctorate level. Not only does the American university require an additional set of course credits roughly equal to that of the M.S. degree, but there are many topics that do not fit into a first-year graduate program and can be offered at least on a once-in-two-years basis. Accordingly each professor was invited to specify one first year and two advanced subjects as his first choice. Arrangements were also made for rotation of courses; this is obviously a good idea. It also became a rule of the Department that all faculty must teach: i.e., a professor must profess. Possibly this was not a firm university rule, but it appeared to us that a person solely dedicated to research belonged to a private research institution. Over the years, with changes in faculty and the progress of the science, actual courses and course contents have changed as has happened everywhere; but I believe that the principles stated remain in force.

The Ph.D. program went into effect in 1964, and the first graduate was Bradford Bean in 1966.

7. Atmospheric Science Building

With the increasing student body, the addition of Peter Sinclair from the University of Arizona to the faculty as a turbulence expert with thesis on dust devils, and research expanding to a rate of $1,400,000 per year, our space on top of the engineering building in the foothills became very crowded indeed. For some time I had been observing this, as well as a nice and empty hill just east of the engineering buildings, or the last bastion of the Rockies before the complete onset of the midwestern plains. I now made some mumbling noises about possible location of a department on this hill to Dr. A. R. Chamberlain, then employed as chief assistant of President William E.

Morgan. He was of course hesitant, but not negative, and suggested that I submit a plan of what I had in mind, of course with cost estimate.

Now I am no architect; but I did recall attending the opening of the new High Altitude Observatory Building on the CU campus several years earlier. It seemed a nicely constructed and useful building — some 80 percent useable space. I asked several people, including Drs. Haurwitz and Chapman, how they liked the building; they expressed themselves as very well satisfied. I then talked with Dr. Walter Orr Roberts and asked him whether he minded if a similar building was constructed at CSU; the interior subdivisions of course would have to be different for a building also serving students and instruction. He was quite agreeable and pointed out that the main design had been due to his former secretary Mary Andrews. Who could wish for better? I came away with the plans and herewith the first and often main hurdle in putting up a building was overcome. A building committee formed under the direction of Dr. Reiter was enthusiastic. Next came the other problem, obviously the funding. Application was made to NSF for about half of the $600,000 thought needed -- what pleasant days!! - and Chamberlain thought he had a way to provide the required matching funds. The hill was the agreed site for the new laboratory, with an outbuilding for heavy machinery like radar plus access driveway and parking lot.

My estimate was that the building would be satisfactory until the early 1970's. Then a fourth floor was to be put on top, the first floor was to be converted from machine room to offices and laboratories; the machine workrooms were to be moved to an addition of the side building. With these additions the facility would last until 1980 when, whoever was department head then, would have to think of something new. In this forecast the growth of the Department and its space requirements appears to have been fairly well assessed. But the history of what happened turned out rather different. From the first we noted that there was a soil type named 'bentonite' on the hill, and we warned the architect that this should be taken carefully into account. Nevertheless, cracks began to develop in the building ceilings before very long; eventually the whole foundation had to be newly supported and thus the fourth floor was never built. The outbuilding was not enlarged, instead some facilities were moved to the buildings of the Christman Airport, just adjacent. So far, so good. But in the 1970's came the development of the solar houses on the side of the hill which, to say the least, do not adorn it.

Construction of the building was begun in late 1965 and it was quite a ways out of the ground when I went on sabbatical leave in 1966. On return one year later it was finished and occupied.

8. Termination as Department Head

The 1967-68 academic year passed peacefully. Dr. M. Corrin had joined the faculty in atmospheric chemistry, one of our much-felt deficiencies. Another one was in the subject of radiation, especially when Dr. Marlatt decided to move to the College of Forestry. How this vacancy was filled successfully, belongs to a subsequent part of the

Department history. I began to feel that the drive carrying me through the period of buildup was ebbing, and I thought often about the validity of limiting high political appointments to two four-year terms. There was also the ever-present danger of developing an inverted pyramid. We started with one professor, one associate professor and two assistant professors, a simple pyramid. The sign of an old institution is a complement of professors, all of full rank, with little underneath. Only a continued growth situation or a removal of older faculty to other positions makes it possible to avoid such a development.

Accordingly I had a conversation with the president Dr. Wm. E. Morgan, who advised me just to take it easy and rest on what had been built. To my disadvantage, but undoubtedly to the advantage of the Department, I disregarded this advice and sent in my resignation on 7 June 1968 pointing out that everything I had promised in 1959-60 had come to pass or had been exceeded, and that rotation would be in the best interests of the Department.

Many former students now are well known nationally and occupy important positions. The research support level has held up in spite of a deteriorating research climate. In scientific meetings there are many contributions by CSU faculty. Many general meetings have been held there, and several new ones are planned for 1983 from the calendar.

In driving on the Overland Trail northward from Prospect Street the building stands out cheerfully in its place, with the new large white antenna confirming the march of progress.

2. A HISTORY OF THE ATMOSPHERIC SCIENCE DEPARTMENT - A LONG TERM PERSPECTIVE

by

Lewis O. Grant

Carefully documented historical accounts serve many purposes: satisfying curiosity and interest, documenting past errors and wise decisions, providing a base for planning for the future, putting actions and philosophies in perspective, providing entertainment, etc. Time has not permitted this particular historical account to be carefully documented or complete. It is based largely on memory of perceived events. It covers, to at least a small extent, all of the many purposes for which historical accounts are written. Needless to say, memory without review and documentation is often flawed.

A Basis for a Department of Atmospheric Science

The CSU College of Engineering was led by a progressive and enthusiastic group of scientists and administrators during the late 1950's. They were thinking and talking of strong program areas, top scientists to head these programs, improved facilities, and an expanding financial base for these programs. This was particularly true in the Department of Civil Engineering. It was this strong, basic group that has led to the national reputation of the College of Engineering and particularly the leading position of the Civil Engineering Department in the 1970's. Even in the late 1950's CSU was a nationally recognized leader in problems related to water, and the fluid mechanics program was rapidly expanding. The main administrators of the college, Milton Bender and A. R. Chamberlain, were exploring ways of strengthening the college program even further and in broadening its base. In Civil Engineering the 'water' program was strong in areas dealing with surface and underground water portions of the hydrologic cycle. They recognized that the atmospheric portion of the cycle was being only weakly addressed and that this constituted an area that needed attention. Further, while it was not particularly well focused at that stage, the common interests of Jack Cermak's fluid mechanics laboratory program and the atmosphere itself were becoming obvious.

Perhaps the catalyst that brought these factors into focus in terms of a definite Atmospheric Science program at CSU was the involvement of a Civil Engineering Professor, Richard Schleusener, and his program to evaluate hail suppression programs in eastern Colorado. While his doctorate was in irrigation engineering, his earlier degrees included a background in meteorology and a military tour of duty as a weather officer.

Thus, by the time I arrived at CSU in the fall of 1959 the Civil Engineering Department was involved in atmospheric aspects of hail

suppression and in a rapidly developing interest in the atmospheric portion of the water cycle and the fluid mechanics aspect of the real atmosphere. My first assignments, all with Contracts and Grants support already in force, were related to the hail suppression program and more specifically the analysis of extreme runoff from small watersheds. This latter program provided more support than the hail program since the design of culverts and bridges was a vital aspect of the program to build a system of national highways and freeways.

The Assembly of the Elite

By the early 1960's the commitment to a strong Atmospheric Science program (not necessarily a department) was firm. Recruitment efforts to head up the program were focused on Dr. Herbert Riehl. The recruitment program proceeded in an 'on' and 'off' basis for many months. It included trips by Herb Riehl to the small city of Fort Collins, still less than 20,000 population and CSU with about 5,000 students. The arrangement was finally consummated after a trip to Chicago by acting Dean of Engineering, A. R. Chamberlain, (following an 'off' period in the negotiations) late in 1960. It was agreed that Herb would join the Civil Engineering Department at CSU. Everyone involved was enthusiastic that this bode well for the future of the Atmospheric Science program at CSU.

But a program must have a faculty and Herb immediately went to work on this little detail. It isn't surprising that his attention was focused on Chicago. Within a short time the Chicago Mafia had been assembled: Herb Riehl (Program Head), Ferd Baer (dynamics), Elmar Reiter (jet streams--two stints at Chicago), Bill Gray (general circulation and tropical meteorology), Arthur Pike, and Arnold Finklin. Bill Gray, and subsequently Arthur Pike were still struggling to finish their Ph.D. degrees. Arnold Finklin was working on a masters degree. Bill Marlatt, now in the Natural Resources Department was the exception to the Chicago background of the new faculty and provided a tie with the agriculture program at CSU. And, yes, Richard Schleusener and I were involved with the program.

Not much later the assembling of the support staff, which has contributed so much to the Department, was started. Early recruitees were Bill Green, a retiring Navy weather non-com; John Vetter, to handle the books; Earlene Bradley to run the Department lab collection (we weren't allowed to call it a Department Library) and Hedi Sargent as Herb Riehl's secretary. The early efforts of Don Garfield, a support staff member of Civil Engineering, constituted an outstanding contribution to the group. Early Department secretarial duties were handled in an excellent manner by the Engineering Department Secretarial Pool headed by Golden Fitch. One of the part time typists in that secretarial pool was Judy Cobb, who in the late 1970's became the Department secretary. Other later but still early Department support staff who quickly come to mind include Elmer Sterkel, Don Cobb, Jerry Price, Sally McLeland, Juanita Veen, and John Siglowski.

When a Department was actually authorized in 1962, Richard Schleusener and I had the choice of staying with the Civil Engineering

Department or joining the Atmospheric Science Department. I chose Atmospheric Science, Dick stayed with Civil Engineering. His interaction with both my project at Climax and the Department program remained strong until his departure for the School of Mines in Rapid City, South Dakota. The School of Mines and CSU program interactions even then were substantial. This interaction continues to the present with the joint appointments and graduate arrangement between the two departments. Dr. Schleusener progressed from Head of the Atmospheric Science Program at the School of Mines to his present position as President of that institution.

The Chicago Mafia was diluted by the late 1960's and early 1970's as the Department expanded. With each expansion the selection was laborious and drawn out. Always the strongest available candidate was sought for the specialization area being filled at the time. The emphasis on potential compatibility of each new faculty member with the existing faculty has, over the years, paid real dividends in Department harmony.

Housing for the Department

The 'B' wing of the Engineering Building was the first home of the CSU Atmospheric Science group, both before and after it became the Atmospheric Science Department. This was an excellent location in these early phases in that it facilitated strong interaction with the other engineering departments and provided an environment for close relationships to develop with many of the other university faculty. The old Hydraulic Lab and Weather Station were just west of 'A' wing of the Engineering Building. The area where those two facilities were is now covered by the northern portion of the Student Center. The Hydraulic Lab was an old large, impressive structure with a curved roof. The work now carried out at the Cloud Simulation Laboratory was carried out in this building. Map discussions were orchestrated personally by Herb Riehl and conducted daily by the faculty in the hall of the Engineering Building on a scheduled basis.

The next home for the Department was in the western portion of the third floor at the present Engineering Research Center at the foothills campus (the eastern section of the present building was not yet even in the planning stage). This atmospheric science space expanded within a year or two to include the quonset type building to the west of ERC. Classes, of course, remained on the main campus. While this was quality space, it did not provide for the focusing of common program interests of the faculty and staff or, on the other hand, permit easy interactions with other groups at the university as had been possible from the Engineering building. But no matter, Herb Riehl was busy on plans and proposals for a building just for Atmospheric Science. In that age and time, support grants for research buildings were possible through NSF. Such buildings had to be for research only (classrooms not permitted) and they had to be cost shared with the state. The NSF grant covered approximately 60 percent of the building cost (with Fred White of NSF giving the final okay), while the other 40 percent was provided from university funds which were repaid from department overhead earnings over the next several years. Herb Riehl and Bill Green spent many hours

and days on the final building plans and arrangements. The basic design of the High Altitude Observatory of the University of Colorado was adopted and modified to fit the specific location of the building. First, there was a concerted effort by the Department to have it located on the main campus. This was even more strongly resisted by the administration since all campus space was already allocated, or included, in the plans for development. In a final conference on the matter, in which a number of us participated, the university administrators offered a campus site off the oval near the railroad tracks--but--they would give no assurances, and even indicated the liklihood, that one floor would have to be assigned to one of the humanities departments. This made the decision easy since almost all of the planned space was even then needed by the growing Department. The foothills campus was to become the home of the Atmospheric Science Building.

The other item of interest relates to the exact site at the foothills campus. We all liked the hilltop site. An overwhelming consideration for the site, however, was Herb's concern for the safety of the building should Soldier Canyon Dam fail and let Horsetooth Reservoir water rush down the canyon. There were a number of discussions, some serious, some in jest, as to whether even our little knoll was high enough to survive such a catastrophy.

With the many hard decisions and work past, the building came into being and was occupied in 1967, just five years after the creation of the Department. As pressure for more space increased with Department expansions, numerous modifications have been made to the building. The basic design, however, has served the Department well. Original plans provided a structural provision for expansion to a fourth floor. Subsequent problems with an unstable soil structure eliminated this approach. Thus, expansion has been to cluster buildings of which there are now four, with others being considered.

Expansion also extended to the airport about a quarter of a mile to the east. At about the same time that plans were being made for the main building, Roger Steele of the Mechanical Engineering Department and I were working on plans and arrangements for the Cloud Simulation Laboratory. Laboratory space was becoming a pressing need with the loss of the old Hydraulics Lab on campus and increasing pressure for space at the Fluid Mechanics Lab at the foothills campus. The Cloud Simulation Laboratory was financed out of research contracts and university support, again largely from return of overhead earnings. The Cloud Simulation Laboratory continues to serve the Department well, providing both top quality laboratory space and expansion room for offices and storage. Department use of other airport space has included both hangar, storage, and limited office space. They continue to be available to the Department. Successive Department initiatives for offices and laboratories through the years have been rewarded with what is now one of the most satisfactory facilities available to any Atmospheric Science Department (this despite the fact that currently space is very tight).

The Department Program

The philosophic outlook of the Department during its early development was largely framed by the CSU College of Engineering and Herb Riehl. All faculty were deeply involved, however, and there was basic agreement on all major issues. Several of the Department policies formed in that early period are worthy of note since they have served the Department well and provide the framework for significant parts of the present Department structure.

An essential concept during the early stages of the Department was that there should be areas of specialization headed by a single dedicated faculty member. When several such areas were considered together, this was conceived as a program which could lead to a broad, balanced program and still provide for areas of specialization. During the early stages of the Department's development there was strong resistance to having multiple faculty members specializing in any one area of atmospheric science--be it any of the areas represented in the early program, dynamics, general circulation, cloud physics, or tropical meteorology. This was perceived as a system to permit development of strong individual programs but to inhibit a department-wide specialization in any one area.

Continuous efforts have been made throughout the Department's history to identify vital specialization areas not covered and to promote their development before any of the existing areas were expanded. Emphasis was placed on radiation during the late 1960's and led to the addition of Steve Cox and Tom Vonder Haar (the third and present Department Head) to the Department faculty. The emphasis during the early 1970's was on atmospheric chemistry with the addition of Mike Corrin. Richard Pearson has now filled that position. The focus of new programs in the mid-70's was on climatology with the addition of Tom McKee, and in the late 1970's on mesoscale and synoptic meteorology with the addition of Dick Johnson and Roger Pielke. During the 1972 internal Department evaluation, Bill Gray introduced the term 'fiefdoms' to describe these independent programs within the Department. While this may sound very fuedal, the system has worked well with many strong special programs but the closeness of the faculty still remains.

Closely related to the concept of a broad-based program, but with strong areas of specialization has been the design of the degree requirements in the M.S. program--approximately one-half in a broad-based core program and one-half in an area of specialization. The broad-based, strong background is compatible with an advanced academic program. The area of specialization is compatible with the Department's home base in the College of Engineering and helps assure that the Department's graduates not only have a solid background but also have an area of expertise in which they are employable.

The recognition of the importance of a solid research effort to a strong graduate program has and remains as a basic Department philosophical outlook. The Department has always taken the position that half to two-thirds of each faculty member's time should be devoted

to research. Thus instead of a fully supported academic faculty of four to six (the approximate present level of university academic support), the Department benefits from the strength of a faculty of around 12 with a broad and deep range of expertise.

The Department Growth Phase

The Department increased in faculty numbers from the original 6 to about 12 during its first ten years. The new size gave the Department the broad coverage desired. The leveling at this size was intentional, and, with minor variations, the faculty size has remained steady during the second decade of the Department existence. As with the faculty, the student contingent increased steadily from one, James Rasmussen, to around 60 to 70 by the end of the Department's first decade. Again by design this has remained essentially constant during the second decade. The leveling of faculty and student population during the 1970's, however, cannot be equated with a continued lack of growth. The numbers of research associates, space used, Department facilities and capabilities, and Department scientific contributions continued the steady growth of the Department's first decade.

During the second decade, growth took place within the various sub-groups of the Department. This growth largely came about by the addition of strong research scientists, as research associates, to the respective groups. Their contributions to the Department have and continue to be substantial. They have added to the scientific output, graduate student exposure, and to the financial support base of the Department. While these additions have required more space, they have helped make possible the availability of outstanding special facilities: computer terminals, the satellite base station, special facilities such as the Cloud Simulation Laboratory, and field observing systems. The growth in scientific contributions in terms of publications, service on national and international committees, and governmental and private agencies, and contributions of Department graduates has more than matched the Department's growth in size. The formation of the Cooperative Institute with NOAA (CIRA) in 1980 added an additional positive dimension to the Department program. The annual faculty retreats, which started in 1971, have helped in the planning for the growth that has occurred.

Substantial additional opportunities for growth in both the depth and quality of the Department program still exist. These can result from (1) continuing and substantial additions to the sophistication of the Department research facilities (satellite station, cloud simulation laboratory, field observation system, etc.), (2) the addition of a few research associates in key research programs, (3) increased scientific interaction with other research scientists through additional cooperative institutes, and (4) continued strengthening of the faculty and student body. It is far from certain that such Department strengthening can occur, or that even the present program can be maintained, in view of university administrative attitudes, programs, and policy changes that have occurred during the past year.

Memorable Events

Human memory takes peculiar twists and turns. Each of us has particular retention and perspective on certain events. Some of these have general significance - most do not. The following are a few that have particular clarity to me.

My first impression of what Herb Riehl conceived for a program of Atmospheric Science is still vivid. During his visit to Fort Collins, several months before he accepted the position, I accompanied him to a meeting with Dean Bender and Ray Chamberlain. The discussion got around to what might be included in the Atmospheric Science program. Herb started writing on a sheet of paper while he talked. He was talking, writing, and describing a program with six courses, which for purposes of identification he listed as: Dynamics I, Dynamics II, Dynamics III, Dynamics IV, Dynamics V, and Dynamics VI. Not being a dynamist and not knowing Herb very well at that time, it is an understatement to say that I was shocked to hear what he envisioned as an Atmospheric Science program at CSU. The shock faded quickly after the meeting when he explained what he envisioned for inclusion under these broad categories.

A second memorable impression relating to Herb Riehl concerns an experience at Climax during the Climax field experiment. One very cold morning, Herb, against several people's advice (including mine), departed from Tennessee Pass on snowshoes to cross over Chicago Ridge and travel to our operating base at the High Altitude Observatory near Climax, a straight line distance of about six miles. As one has to travel, over the ridge which is above timberline and around gullies and wooded areas, the distance is at least two to three times six miles. This is a substantial trip even in summer, and it was January with three to five feet of snowpack and temperatures near 0°F. Jamia Riehl and I started becoming concerned as evening approached with no sign of Herb. Just at dark, as we were getting set to call in emergency crews, Herb appeared at the door. He attempted to explain that we shouldn't have been concerned. This was one time though when we had a one-sided conversation with Herb - with us doing all of the talking. He would try to talk. His face and lips were so frozen that no sounds came out.

Another event that sticks in my mind occurred shortly after the formation of the Department. It was Ferd Baer's turn to give the map discussion in the hall of the Engineering building. It was the first time I had heard a synoptic weather map discussion by a dynamist. It was a real experience.

I remember well Elmar Reiter's (our second Department Chairman) arrival in the arid west: Fort Collins. On the day of his arrival we had a downpour that would have a 'return period' of at least 25 to 50 years. The west side of town was inundated.

For unpleasant memories try topping this one. From 1965 to 1967 our group actively worked at putting all of our Climax data and programs on cards. At that time these were still run directly onto the CSU computer. When the Department moved from the second floor of the ERC building the movers took everything to the end of the hall and lowered them to the ground by cable. They dropped the load carrying all of our cards. The windy day then provided the distribution system

(fortunately, Ed Hindman's thesis had just been completed).

A tree grows at the foothills campus. The beautiful Buckeye tree presently in front of the Atmospheric Science building originally was bulldozed out and dumped on a pile of trash near the campus weather station during the construction of the Student Center. Bill Marlatt and I noticed it in November 1966 and tried to move it to the new Atmospheric Science building. We couldn't lift it and by the next day, when we hoped to get reinforcements, a cold spell had frozen everything for the winter. When it still showed signs of life the following April, we went ahead with the moving, but were very clumsy and scratched the bark badly. It was a good omen for the Department that even after those hardships, and the poor soil of our knoll, the tree has survived and thrived.

One of the finest compliments to the Department that I have had came in relation to an employer looking for a CSU student. He called and asked if I had a good student to recommend. I told him that I didn't have any students about to finish at that time. His response was to the effect 'Well, can you recommend some other department graduate. I would really like to fill the position with a CSU student; they know how to get things done.'

3. REMINISCENCES

by

Elmar R. Reiter

My first acquaintance with CSU came on a spring day in 1961 while sitting in my office in Innsbruck. I received a long-distance call from the U.S. -- not an everyday occurrence in Innsbruk. It was Herb Riehl, wanting to know if I would join him for a year in Colorado. He was planning to start a new meteorology program there. I was so flabbergasted that I said 'yes'. Only after I had hung up I realized that he did not say 'Boulder', -- a city which I knew from an earlier trip --, but 'Fort Collins'.

The only atlas available in the office was from the late 1800's. Fort Collins was shown somewhere north of Denver in 'Indian Territory'. My first thought was: 'Oh my God!'

There still were a few things to be done before my departure. First we had to await the birth of my youngest daughter. Then we had to get the appropriate visa. As it turned out, I was in line for an immigration visa which made things considerably simpler. Then we invested our net cash in a Mercedes and took off for territories unknown. The exciting part of the long voyage (3 small children sitting on top of suitcases in a sub-compact car whose rear axle was sagging from the weight) came somewhere west of Sterling when we had our first glimpse of the Rockies. We knew that we had to be in 'Indian Territory' by now. We approached on Highway 14, coming over the rise east of what is now I-25, but then was only an ordinary road, there still was no sign of Fort Collins. Finally we passed a few houses and drove across an intersection that said 'College Avenue' -- then a few more houses and pretty soon open fields again, with mountains ahead. We had to turn around again. Obviously we had driven right through Fort Collins without even realizing it. All we could say was: 'Oh my God!'

I tried to make a few telephone calls to let people know that I was here. Herb Riehl was out of town, but he had instructed Lew Grant to take care of us. We settled in the Armstrong Hotel on College and Olive. Our room faced west, and several trains ran right through it that night.

Things started to look up, however. I met the 'old deck hands' who had beaten me by a few days or weeks: Lew Grant, a research associate, Bill Green, the Program Administrator (since I did not know what that was I assumed that he was my boss), Dick Schleusener and, last but not least, Herb Riehl who immediately organized a cocktail party in his house on Shields Street in order to get the crew acquainted with each other. His martinis were absolutely lethal and needed getting used to. Within a few days Ferd Baer, Bill Marlatt and Bill Gray (who then was 'only' a research associate) showed up. We were complete, at least for the time being.

It was the end of August 1961, still fairly hot -- when we moved into our offices in the relatively new Engineering Building, B-Wing, on the edge of a sleepy campus that expected a little over 6000 students to show up in fall. Our offices faced west, there was no air conditioning, and room temperatures became unbearable after 12 o'clock. Where the Student Center stands now, there was an old 'lean-to' shack attached to the engineering building. It housed a small wind and water tunnel -- Jack Cermak's little empire. In this shack Lew Grant and a young engineer who had nothing much else to do, Roger Steel, began to tinker on a cloud chamber — the first experimental facility of our program. Beyond that shop facility, a little farther to the west, was the Weather Station -- nothing more than an instrument shelter with chicken wire around it -- but nevertheless a symbol of our ambitions. Beyond that was open pasture land, irrigation ditches and buffalo chips.

If I remember correctly, the academic quarter began in September and, lo and behold, one student showed up: James Rasmussen. (Actually, there were five students, but two took flight after they discovered that they were outnumbered by professors, and two flunked out.)

Things went reasonably well for a while, especially after the offices cooled down in fall and the mud puddles in the parking lot to the north of the building froze over. But it was only the calm before the storm! Knowing Herb Riehl, one would expect that the natives, under engineering rule, would become restless sooner or later. Actually, it was sooner -- in early 1962 (I believe it was in March). Herb had called an urgent staff meeting for the evening in the Engineering Department Head's (Milton Bender's) office. No one knew precisely what was up, but we found out soon enough: Herb did not want to spend the rest of his life taking orders from an engineer. He was getting tired of being the brake man riding in the caboose; he wanted to ride up front in the engine: We deserved to have our own Department! Poor Milt Bender was not very quick on the draw, not against Herb and his crew; he was totally out-gunned, and on that fateful evening the Department of Atmospheric Science at Colorado State University was born: four professors, one student, one secretary who ran the show (Hedi Sargent), and a few 'odds and ends', like Bill Green, Arthur Pike, etc.

From thereon things started to move with increasing speed. The engineers had planned a research center on a wasteland site west of town. Our fledgling Department muscled in and took over half of the top floor. Since my downtown office became rather unbearable again during spring of 1962, I was the first to move to the new facility west of town. Not many people were out there during these early days of the Engineering Research Center, but there was lots of wildlife: mice in my waste basket and rattle snakes on the front steps of the building. Soon, however, the offices began to fill. We bought the late Harry Wexler's private library. His books and reprints formed the foundation for our Department Library, nurtured from a few filing cabinets of junk to what it is now by Earlene Bradley. Soon we began to overflow, especially on account of Lew Grant's field projects in the mountains near Climax. An instrument shop had to be established. It was housed in a small Butler building between the ERC office building and the newly erected wind tunnel annex. (Jack Cermak's operation was growing almost

faster than ours for a while.) I remember the long discussions about the problem of taking the electronic technicians into the civil service system. They decided to become independent and formed Western Scientific, the first company of its kind in the region. Now, since we had fathered this child, it became time to set our sights higher. In 1965 Herb began to negotiate with the National Science Foundation to provide matching funds for a new building to be dedicated to the Atmospheric Sciences. Herb's quest succeeded and most of that year was spent with the architects, Heinzman and Ingalls, to draw up the plans. Bill Green became indispensable: he planned the location of every electric outlet, every telephone connection, every wire.

Then, in 1966-67 we watched the new building rise from the horizon of 'Bentonite Ridge'. If the architects had been more careful with the foundations, the building would not have continued to rise, even after the construction work was finished. The center of the building, which contained a small basement with the heating plant, was built on cardboard spacers to protect against soil expansion. Unfortunately, the rest of the building was not protected in this way, and soon cracks in walls and floors began to appear.

Herb Riehl had fled the country before the construction and the moving phases, leaving the Department in my care. He had left instructions to offer the 'spare space' in the building to Dr. Yevjevich from Engineering, before someone else would claim squatter's rights in the empty rooms. However, by the time we moved into the new building in February of 1967, we were able to fill it quite comfortably without Dr. Yevjevich's help, thus verifying one of Parkinson's laws.

The dedication ceremonies in June of 1967 started under bright and sunny skies with a number of speeches given on the front steps of the new building: CSU's President Morgan, Vice President Chamberlain, U.S. Senator Dominick, Dr. Fred White from NSF, etc. Celebrations continued at the Country Club in the late afternoon, but in the meantime the weather decided to demonstrate its meteorological capabilities. On the way to the club I saw the first and only funnel clouds that I ever witnessed in Colorado.

Shortly after the ceremonies, and after the Symposium on Mountain Meteorology that brought our friends together from far and wide, I packed my cases to go on sabbatical leave to Austria and Germany.

Upon my return I learned during a visit with 'Slim' Somervell and the Navy in Norfolk, VA., that Herb Riehl had decided to "throw in the towel" and a new Department head was being sought. I was quite alarmed about this news, and I became even more alarmed when I arrived in Fort Collins to find out that the choice had fallen on me. I had a lot to learn, especially how to handle a conglomerate of prima donnas. (Herb had added Pete Sinclair and D. B. Rao to the faculty, each as strong-headed as the rest of the crew. Bill Gray and Lew Grant also had become full-fledged faculty members.) The first year on the job was not easy. I had just returned from Germany where the universities were rife with student unrest and violent demonstrations. One of my first suggestions as department head was to allow elected student representatives to sit,

with voting rights, in our faculty meetings. At first, this suggestion caused quite an uproar, but I succeeded with the argument that one gets more mileage out of giving something voluntarily before it is taken away by force. Our Department was the first in the university to embark on this democratization process. Almost immediately we found proof that the decision to let the students participate in the decision-making process was right. I received a number of threats that our building would be blown up, because we were 'doing research which supported the war effort'. The students and faculty together decided that we would not surrender the building, as the university administration cautiously suggested, but that we would occupy and defend the building 24 hours a day. The students mounted an old military surplus spotlight on the roof. The light could be trained on cars approaching along Laporte Avenue. The police promised to patrol the area regularly to see if we were still alright. Mike Corrin, whom I had hired shortly before these incidents, and I even took out gun permits -- just in case. Thank heaven, our vigilante group was never put to the test. I will never forget those sleepless nights, however, nor the unanimous student and faculty support. Soon afterwards the Old Main Building went up in flames, bringing to a fiery finish the years of student turmoil at CSU.

The years came and went. So did some of the faculty: Schubert, Cox and Vonder Haar came, and Marlatt, Rao and Baer went. Slowly but surely our Department turned into one of the fattest overhead milk cows on the campus. By 1974 I had developed the 'Herb Riehl Syndrome': I had it 'up to here' fighting for every nickel of salary money, keeping ourselves in the black while watching other departments fall into red ink and being rewarded for it. I felt that if I pulled out now I still could <u>do</u> research, not just organize it. Besides, it was time to hand the standard over to younger people, just as Herb Riehl had done.

4. SOME IDEAS ON HOW WE GOT HERE

by

William M. Gray

I was a graduate student at the University of Chicago when Herbert Riehl offered me a job on the research staff at CSU in late 1960. Herb had been my advisor at Chicago from 1957-60 and had arranged for me to make summer visits to the then new and exciting National Hurricane Research Project (NHRP) at West Palm Beach and Miami, Florida. I had already finished the course work on a Ph.D. degree at Chicago by 1961 and came to CSU to write a thesis on a hurricane topic from the grants Herb had going with NHRP at that time and also (if things went as hoped for) to participate in the growth and development of the Department as a faculty member. I finished the formal requirements for the Ph.D. at Chicago in 1964 (with advising help from both Sverre Petterssen and Horace Byers at Chicago) and then was accepted as a regular Department of Atmospheric Science faculty member. My first research paper at CSU (Atmospheric Science Paper No. 1) titled "On the Balance of Forces and Radial Accelerations in Hurricanes" was issued in February 1961 and was an outgrowth of the M.S. thesis at Chicago.

A few Chicago meteorology faculty were quite dubious of Herbert Riehl pulling up stakes at Chicago after a most profitable 15-18 year tenure there. One prominent Chicago faculty member told me he could not understand why Riehl wanted to leave such an outstanding university as Chicago and go to (what he described as) a 'third-rate institution' like CSU (or Colorado A and M as it had been known until 1957). How could Herb attract and keep a top flight faculty and student body at such an out-of-the-way place as Fort Collins? CSU definitely had strong 'cow' connotations at that time. Herb, nevertheless, left the somewhat cloistered and hallowed atmosphere of Chicago for the rigors of forming a new meteorology group at a university little known and recognized for graduate studies. (CSU's first Ph.D. having not been awarded until 1957). Overall it was certainly a wise and farsighted decision when seen in retrospect. But to do this Herb had to dilute much of his active research program at Chicago. Administrative duties, entertainment, and the hundred-and-one other miscellaneous duties took much time from what had previously been used for contemplative thought and personal research. At Chicago Herb typically had but 2-3 graduate students at any one time and a very small support staff. Nobody could have worked harder or gave more of himself than did Herb during the years of 1960-66 to the establishment of the Fort Collins atmospheric science group as an independent academic and research unit. He tells it well in his summary.

The Growth Decade. Very few people in the early 1960's could have guessed that our Department would be able to develop into one of our country's most active graduate level institutions and be able, gradually, over the years, to attract so many capable graduate students and a most capable and active new young faculty. I'm sure that the nice

living conditions and climate of Fort Collins were a significant factor in our growth as was our Department's proximity to the mountains and to the growing Boulder NCAR and NOAA atmospheric science programs. A drive to Boulder in those days took less than an hour. I remember visiting a very small and old gymnasium located on the side of the Colorado University campus in 1961. That was all there was of NCAR, a staff of 8-10, but a conception and an anticipation of big things to come. But who could have conceived of Boulder becoming the massive Center for Atmospheric Science Research that has taken place?

We were also fortunate during the 1960's that the Sputnik age was running strong and research funds in the physical sciences were much more available than they are becoming to be now, or as they were in the generally depressed research environment of the Eisenhower years. And universities were in their most active growth phase following the World War II baby boom and the general perception that a university degree offered optimum upward economic and social mobility. About 7,000 students enrolled at CSU in the autumn of 1961. By the late 1960's this number has risen to 17,000, a 150% growth that paralleled the growth of Fort Collins during this period.

One of Herb's early Department needs (as I saw it) was holding the initial staff he had assembled in 1961, especially the more experienced staff members like Elmar Reiter. Elmar was on a 2-year leave of absence from the University of Innsbruck and naturally appeared to dress and think, at that time, a bit more European than the rest of us. By the summer of 1963 when Elmar's allocated time away from Austria was drawing to a close it appeared touch-and-go as to whether he would stay at CSU or return to assume his regular faculty position in Innsbruck. And then one morning Elmar arrived to work wearing a big cowboy hat with boots, plus Levi trousers, a wide belt and a huge buckle, and a red cowboy shirt. That was it. The decision to stay had been made.

Movement Away from the Big Cities. United States university meteorology departments in the 1940's and 1950's were often located in the shabby buildings of converted private houses. A number of big departments were located in the center of large cities (Boston, New York, Chicago, Los Angeles) with their ever growing urban problems and long commuting distances. But why must one live in a big city to teach or study meteorology? Graduate students and especially faculty with families are (in general) more attracted to smaller communities. This was becoming more the situation when jet aircraft travel developed so rapidly in the late 1950's and early 1960's. It became possible to remain in the "center of action" so to speak and still live many hundreds or thousands of miles away in a small university community in the west.

Having lived in big cities all my life (except for 4 1/2 years in the Air Force) and having recently moved from a ghetto area around the University of Chicago, my wife Nancy and I were quite cognizant of the sudden lack of big city problems when we first moved to Fort Collins in 1961. At first I felt somewhat guilty of having abandoned or perhaps retreated from the mainstream of American urban life and action with its fundamental racial problems. It took me 4-5 years to really adjust and

feel at home. There was no baseball, classical music, or good papers in Fort Collins in 1961. All this has changed now and it would be difficult or nearly impossible for us to return to the big city.

The development of computer links in the early 1970's made access to the largest computers available at out-of-the-way locations like our CSU Atmospheric Science building. Thus, we have been fortunate over the last 20 years to have many of the changing U.S. urban and social trends acting in our favor. Scientific funding and technical changes were also operating in our favor. But can this continue?

Hard vs. Soft Money. Our Department has bucked the traditional university concept of faculty members' salary being fully supported by their university for nine or twelve months. Traditionally about half the money of our faculty's salary is paid through our research grants. Although many traditionalists abhor such a funding structure we have been able to survive and find some aspects of this situation beneficial. We could not have the large and broadly disciplined faculty we have without such a funding arrangement. The traditional university attitude says that such a funding structure as we practice does not lend to stability. This is partly true but one can also argue that full academic salary coverage by the home institution can foster a greater allegiance to the university system rather than to the specialized research endeavor of the faculty member and his graduate students. A fully funded salary from the university may require the faculty member to teach more courses and serve on more university committees, etc. If one is quaranteed a full salary for many years, will not his incentive to obtain new research grants and to participate in on-going research be diminished somewhat? Of course, there are many arguments against such a philosophy and practice. A number of us at times have greatly regreted we have such a system in our Department. Nevertheless, such a system has generally worked for us. Whether it will in the future is another question.

Many of our faculty feel a greater pressure to produce research and obtain grants than we otherwise might if a full year's salary were guaranteed. I believe our Department's research productivity per faculty member is generally higher compared with other institutions where full 9-month or 12-month university coverage is guaranteed. Graduate level teaching is primarily a one-on-one exchange with graduate students and is often not properly measured or appreciated by university administrators, government administrators, or the general public.

We have been quite appreciative that enough NSF, NASA, NOAA, DOD, and other government agencies have been impressed enough with our program to help us develop and grow through the years. We have been grateful through the years to the continuing basic research grants given to us by the National Science Foundation. We have been especially thankful to Fred White (former director of NSF Atmospheric Science Program for many years) who was the one that arranged the necessary federal support such that our Atmospheric Science building could be constructed in 1966-1967. Fred helped dedicate our building in 1967. We have also been appreciative of the continuing NSF support and encouragement given us by Eugene Bierly, Richard Greenfield, Jay Fein

and other NSF Atmospheric Science Grant monitors.

A decision was made early on by Herb Riehl that he would try to hire only young faculty members and let them grow in their fields at CSU. This practice was generally followed. With the exception of Bernhard Haurwitz and Herb Riehl most of our faculty have developed their reputations at CSU.

Development's in the 1970's. A perceived need for radiation and satellite expertise during the late 1960's led to the hiring of new faculty members: Steve Cox in 1969 and Tom Vonder Haar in 1970. Both arrived at CSU with extremely well developed knowledge of how university R and D programs should and could operate and talent to act upon this knowledge (perhaps somewhat a Suomi influence). Steve and Tom have both been very successful. Steve has had a large impact on relating radiation theory to practical meteorology problems. Tom Vonder Haar very early on demonstrated a very high capacity and interest in administration and responsibility assumption. Tom's abilities in these areas have always seemed very high. He has shown much leadership and talent since becoming Department Head in 1974 in helping adopt our research and teaching programs to the changing Federal funding patterns and to the different state and main campus university policy shifts. We have been fortunate to have such a young faculty member with such developed administrative interests and talents. Most faculty members (like myself) enjoy their research and teaching activity more than administration and often do not participate enough in the Darwinian arena ot university and federal research policies and grantsmanship. Tom is now very well recognized for his administrative abilities. He now serves in a variety of capacities on the national and international level and has been successful in developing a quite large satellite program within our Department.

Myron Corrin joined our faculty in 1967 and until his death in 1980 was very active in our Department activities. He was a very talented physical chemist. Mike's office was adjacent to mine throughout his stay and he assisted us with our carbon black weather modification studies and in a number of new ideas on energy development. He had an encyclopedic mind on most subjects except meteorology of which he was rather proud not to be a participant in what he thought to be the 'hocus-pocus' studies of weather analysis and forecasting. We were fortunate to have Dick Pearson join our faculty last year to continue our Department's expertise in physical chemistry.

Our department has been primarily known through its first 15 years for observational and experimental research. Ferd Baer was our only bonified resident 'dynamatician' for a number of years. He was joined in 1968 by D. B. Rao, another Chicago product. When D. B. left our department in 1971 and then Ferd in 1972, we were very hard pressed for expertise in the theoretical and numerical modeling side of our field (a deficiency well noted at that time by other university departments well endowed in these areas). It was at this time that we were fortunate to have Bernhard Haurwitz leave NCAR and join our faculty in 1972 and then Wayne Schubert joined us in 1973. Bill Cotton arrived in early 1975, Duane Stevens in 1978, Dick Johnson in 1979 and Roger Pielke just this

year. We now have a very outstanding and vigorous group of young theoretical and dynamic meteorologists. Many have good numerical computer backgrounds. These younger meteorologists are making great contributions to our program and herein rests the future of our Department. If their development continues along its present course we will likely have little to fear about our Department's future.

Our faculty has been most fortunate to have a number of outstanding research associates and support staff down through the years. I would particularly like to acknowledge Barbara Brumit who has worked with the author's project since 1970.

5. COMMENTS ON THE OCCASION OF THE FIRST 20 YEARS OF ATMOSPHERIC SCIENCE AT CSU

by

Bernhard Haurwitz

I came to Colorado permanently in the summer of 1959 to accept a position at the High Altitude Observatory of the University of Colorado in Boulder. At that time there were apparently no meteorologists in academic positions in Colorado and no university departments offering courses leading to a degree in the subject. My own purpose in coming to Boulder was not to start such courses at CU, nor to start a department (Heaven forbid!), having just given up the chairmanship of the Department of Meteorology and Oceanography at New York University. Instead I wanted to devote all my time to do research and teaching in specialized advanced courses.

My first knowledge of plans to form a Department of Atmospheric Science at Colorado State University came with a telephone call from Herbert Riehl, sometime in, I believe, 1960 explaining that he was planning to come to CSU to start a Department of Atmospheric Science. His specific reason in phoning me, he said, was to inquire if such an action was going to interfere with any plans for a department at the University of Colorado. I assured him that I had no such plans for a department at Boulder, but that I should be very happy if his plans at CSU were successful because it would bring additional meteorologists in the area. The present size of the Department at CSU is testimony that this is exactly what happened, although the growth of the Department to its present size took obviously some time, and I am sure, a lot of hard work on the part of Herbert Riehl and his successors in the chairmanship.

A few years after the establishment of the atmospheric science group at CSU, Herbert Riehl asked me to teach an advanced graduate course to supplement the teaching program. I gave a one-term course on atmospheric wave motions which became more or less a regular feature and was given every second year. In recent years, after the faculty of the Department has been substantially increased by the appointment of additional faculty members working in dynamic meteorology, the course or a course with similar contents is taught by others.

During my twenty years of living in close proximity (Boulder) to or, lately, at Fort Collins I have been able to follow the growth of CSU and its Department of Atmospheric Science. In this period CSU has completed the transition from an agricultural college to a full-fledged university (whatever that may mean!). To the outsider this development was evidenced by the increasing number of new buildings, with their obligatory parking spaces, going up on the main campus which often made a visit a new challenge to find one's way through an everchanging maze.

The Department itself moved from the main campus westwards to the new Engineering Research Building, and onwards and upwards to a separate location and building on its own hill. Here it is now perched, somewhat precariously because of the physical state of its soil foundation, and looking out over a still growing parking lot.

As has been demonstrated by Parkinson a sure sign of the decay of an institution is its possession of an impressive building planned to perfection and immaculately maintained. Fortunately, even the most casual visit to the Departmental building and its outhouses, erected in close vicinity to allow for the increase in staff and students, will show that by Parkinson's criteria there is no indication yet of a decline of the vigor of the Department.

Quod bonum, felix, faustumque sit!

6. HISTORICAL NOTES OF THE ATMOSPHERIC SCIENCE DEPARTMENT COLORADO STATE UNIVERSITY

by

Peter Sinclair

On my arrival (1966) at Colorado State University (CSU), I drove through the oval on main campus and was somewhat depressed on how old and drab the buildings were that lined this gateway to the University. However, closer inspection of the entire campus area revealed the true nature of the University's plan for the future. Just outside of this 'old' oval, were new, modern buildings housing the library, Engineering College, and the students. Since that time, and especially during the late sixties and early seventies, the proliferation of new buildings to house the ever expanding student population has bordered on the phenomenal. In 1966 the Atmospheric Science Department was housed in a Strand Steel building behind the Engineering Research Center (ERC). Under the able guidance of Herb Riehl we rapidly moved from these cramped quarters to the third floor of the ERC. In the master plan this first move was designed as only a 'stepping stone' to our own Atmospheric Science Department building which was completed just to the east of the ERC in 1967. This new facility, some 30,000 square feet, was and still is today a monument of achievement in the extraordinary leadership of Herb Riehl during those early formulative years of the Department. In addition to these facility building years, I remember also the very special hospitality that Herb extended to all members of the faculty and senior staff to meet in his home after work or in the evening to greet new arrivals to the Department and/or meet new and interesting scientific members of a world wide community. These informal social hours were especially important to the young faculty and staff who were trying to become personally acquainted with their co-workers. In many cases, more science and just good socializing was accomplished at these get-togethers than was accomplished within the walls of our new surroundings.

Also, during this period, Mike Corrin joined the faculty from the University of Arizona. This was an important and strategic addition since Mike brought to the Department extraordinary teaching skills and national recognition as a chemist in weather related research. Since his death in 1980, this Department chemistry capability has been carried forth with the welcomed addition of Dick Pearson from the University of Michigan.

Shortly after the ATS building dedication, Herb began looking for other 'mountains' to conquer and Elmar Reiter took over as Department Head in 1969. The five years to follow were marked by a rapid expansion in our teaching and research endeavors. New faculty (Drs. S. Cox, T. Vonder Haar and T. McKee) and staff arrived and we were rapidly ushered into the era of specialization. Our course curriculum was significantly improved and broadened to cover more of the new emerging atmospheric

science curriculum. This was also an era of plentiful research dollars and the faculty made use of this funding climate to establish itself as a major contributor to national and international research programs.

In 1974, Tom Vonder Haar assumed the duties of Department Head and we continued broadening our research and teaching endeavors. New faculty (Drs. W. Cotton, W. Schubert, D. Stevens, B. Haurwitz [Adjunct], R. Pearson, R. Johnson and R. Pielke) and staff increased markedly and we became an atmospheric science department known for its expertise in a wide range of basic and advanced areas of our science. Important new research tools were developed or reached significant levels of operation during the seventies: in house computer and satellite imagery systems, mountain winter storm facilities, research aircraft capabilities and measurement techniques, and cloud physics and weather modification simulation laboratory facilities. It is fortunate that these facilities were built and became operational before tight budgets recently became a reality - unless the funding picture changes considerably, they will have to be used essentially in their present form for quite a few more years. However, the history of the Department indicates that significant research and educational growth is to be expected even in periods of national economic decline.

THE 1970'S AND BEYOND

7. DEPARTMENT HISTORY

by

Steve Cox

My perspective of the CSU Department of Atmospheric Science begins in the fall of 1969. At that time I interviewed for a position of assistant professor in the Department. I was appropriately wined and dined by Herb Riehl, who was officially on sabbatical leave, and Elmar Reiter, the acting department head in Herb's absence. In this initial interview my potential position within the Department was to join with two other staff members, one academic faculty and one general faculty member, to establish a strong research and academic specialization in atmospheric radiation. I accepted the offer and was to report to CSU in August 1969. To make a long story short, when I arrived at CSU the other two components of the radiation team were gone. I think that this sequence of events illustrates the rather rapid changes and transitions going on in the Department in the late 1960's and early 1970's.

The Department of Atmospheric Science was emerging from an era in which it was vulnerable to both internal and external events into a more mature status when it could better withstand or manipulate circumstances not favorable to the Department. In the 1960's Herb Riehl played the role of the Department patriarch. He very successfully fended off attempts of both internal CSU and external factions to dilute the fledgling Department's effectiveness. However in the early 1970's enough faculty with strong commitments to the Department's role as a graduate education and research leader made possible a transition to a more democratic mode. I do not wish to imply that such a transition should have been made earlier; I strongly feel that the firm control exercised over the Department by Herb Riehl was essential in the early years of the Department.

When I joined the Department, my main cohorts were James Rasmussen and D. B. Rao, also relatively new assistant professors. Jim, D.B. and I struggled to convince elder faculty that our ideas on departmental issues were not radical and that they should be, at the very least, listened to. Tom Vonder Haar joined the faculty about six months after I arrived.

In this same time frame the first departmental retreat was held under Elmar Reiter's department head reign. In one of the early sessions at the first Department retreat, Bill Gray became rather frustrated with, what were to him radical ideas being espoused by the younger faculty members. In his moment of frustration he stood up with arms flailing and directed the following quote at Rasmussen, Vonder Haar and myself. 'You young 'turks' are trying to run the Department from the assistant professor ranks.' Bill wasn't far off but we weren't as successful as he feared we might be. The one thing that did stick was the label 'young turks'. It wasn't until nearly a decade later when I was promoted to full professor that Bill discontinued using that label

when he and I ended up on opposite sides of an issue.

About this same time I became aware of another event which ocurrs annually and seems to have a curious side effect. The event is the announcement of faculty salary increases for the ensuing year. I first became aware of this when Elmar Reiter asked me to be acting department head while he was out of town for a few days in the spring of 1970. John Vetter distributed the little sealed envelopes with the appropriate information contained in note over Elmar's signature. Now, ever since that initial event I have noted a powerful correlation between distribution of salary increase information and department head absence. Rumor has it that this same phenomenon occurred when Herb was DH and I think our current DH has upheld the tradition. I don't know what it is; I guess the strain of it all must make them ill and they have to take a few days off!

In the early 1970's our departmental staff was joined by one who was to become the youngest retiree from the Atmospheric Science Department. Allan Betts arrived with his typical British accent and immediately made an impact upon the Department. His exciting new ideas on cumulus convection were attracting both national and international recognition; his exams in AT 610, a course which we team taught, were gaining a local reputation among students; and his dedication to academic excellence was an important reminder to us all. So in spite of the funny way he talked we accepted Allan, only to lose him to a farm in Vermont in too short a period of time. In the few short years that Allan was here at CSU I interacted with him in many arenas. These varied from faculty meetings, class room teaching, commanding aircraft sorties in GATE, serving on graduate student committees and international scientific committees. I think we at CSU owe Allan a lot for his contributions in the few short years he was here.

Besides the great working relationships we have among the faculty members in our Department, I would like to mention a personal-professional relationship that had a profound influence upon me when I came to CSU. I found that the informal dialogue I shared with Mike Corrin from the very first day I arrived at CSU and continuing through Mike's illness right up to his death, helped shape my views of higher education, roles of research in society and in the university and the advisor-student relationship in graduate education. While Mike and I did not agree on everything, we could always communicate freely with one another. I know that I am a better educator as a result of this dialogue and I am confident that ATS is a better Department as a result of Mike's contributions.

Histories are by their very definition backward-looking. The present and the future somehow seem to be ignored at events like anniversary celebrations or reunions. I would like to finish my contribution with a few words about the present and future of the Department. I think that the Department has reached a stature among universities and research groups that is very enviable. Departmental faculty in several disciplines are nationally and internationally known and well respected. We are very fortunate to have a strong nucleus of associate professors who are even now commanding the attention of their

peers throughout the world. We have recently added new faculty in two disciplines who will undoubtedly extend the reputation of the Department in the near future. Former students from the Department hold positions throughout our science and their progress and contributions are perhaps the best measure of how well our educational program is working. Our future goals for the CSU Atmospheric Science Department will be best insured by each of the faculty continuing his commitment to quality graduate education and quality research.

8. DEPARTMENT HISTORY

by

Thomas McKee

My first experience with the Department came in the fall term of 1968 when I enrolled as a graduate student. I was not quite a typical student since I had been working in research for 10 years for NASA prior to coming to CSU. I was typical of many students since I had no formal background in meteorology. I was immediately aware that the classes varied widely in difficulty, students varied even more widely, faculty varied widely in teaching effort, and seminar quality varied the most widely of all. All of these variations seemed somehow to be consistent with the study of the atmosphere.

The current faculty at CSU which were here during my first year include Professors Grant, Gray, Sinclair, and Reiter. I did not have Sinclair for class that first year. However, students today are still aware that Grant does not know when classes start, Gray does not know when they end, and Reiter can give the best or worst lecture of the year without warning. Variation and change is yet a theme at CSU and all of the faculty add their share. In the midst of it all lies the opportunity for a quality education for those who recognize it is partly in the classroom, partly in the research, and they can not be separated.

After finishing at CSU in the fall of 1971 under the guidance of Professor Cox and spending one year as a temporary faculty member, I left CSU to accept a position at the University of Virginia. I returned to join the CSU faculty in the fall term of 1974 for three specific reasons. I thought the opportunity to develop a state climate project within the University was unique, the Department with Vonder Haar as head would support new programs, and the existing faculty were an exceptional group. The past eight years have confirmed all three. Five new faculty have come to CSU since I arrived. The Department has never been stagnant and has continued to change in terms of classes, facilities, computer capability, and research interests through the 70's and into the 80's. I think the Department is stronger today than when I arrived. While the core curriculum has not changed much, the advanced courses have changed significantly. Students today are working on an exciting array of contemporary problems along with faculty and research staff. I look forward to a bright future for the Department and the graduates to come.

9. PERCEPTIONS OF THE DEPARTMENT OF ATMOSPHERIC SCIENCE

by

William R. Cotton

My first reaction upon entering the Department in January 1975 was something like the culture shock I recently experienced when I entered Hong Kong after three weeks in the People's Republic of China. In China, as in my former NOAA Laboratory in Miami, Florida, the pace of life and activities is very low key. Most work is done in China with a minimum amount of modern technological support. For example, a one-speed bicycle represents the typical form of transportation. In Hong Kong, on the other hand, one is overwhelmed by the 'neon lights', the hustle and bustle of the people, the cars and motorcycles and the modern buildings and factories. As I joined the staff at CSU I had a similar feeling. The intensity of research activity was as high or higher than any place I had visited or worked in the past. The technical facilities here were state-of-the-art including computer facilities, satellite receiving and processing systems and aircraft. It was hard not to become entrained into this scientific activity. It was also impressive to realize that nearly every faculty member was a recognized leader in his/her particular specialization. The competence of the students was also very impressive. The Department was clearly attracting many of the top young meteorologists in the world.

During the period of my tenure, little of this early perspective of the Department has changed. With the exception of the loss in aircraft facilities, the Department facilities including computer facilities, satellite processing facilities and other technical support have become even more extensive and state-of-the-art. The level of scientific rigor has also remained at a high, nearly constant level. New, young faculty members have helped maintain this vitality of scientific activity. The faculty have also been supported by an expanded young, highly motivated and competent non-academic faculty or research associate staff.

The level of competence of the student body has also been maintained at a relatively high level during the period. However, the composition of the student body has undergone some significant changes during the period. It is my impression that while the number of students has remained relatively constant, the proportion of foreign students to U.S. students has increased. I think this is less a reflection on the Department than it is on the young American people of today who are less inclined to do postgraduate work in the sciences. I am very concerned about the future of science in the U.S. in the next one to two decades.

During my seven years here I have seen the curriculum in the academic program continually being re-evaluated and modified based on the recommendations of both students and faculty. The most pronounced changes have been made in the 600 level courses where obvious

deficiencies in the structure of those courses in 1975-76 have been remedied to a great extent. More recently changes in the 700 level curriculum have also been made to meet changes in the faculty and in the needs of the student body. Of course, no academic curriculum is free of some problems, but I have been encouraged by a concerted effort on the part of the faculty to continually evaluate the program and make changes where necessary.

While I mentioned above that the level of scientific activity and productivity has remained relatively constant in the Department in spite of the pronounced decrease in Federal funding, the posture of the Department's scientific research has changed. That is, in the past we have maintained an offensive position in research generally initiating major new research programs and field programs. Under the current funding climate, our position is changing to a more defensive position whereby we are trying to hold the ground we have 'captured' over the years. The question is how long can such a defensive posture be maintained without a severe loss in scientific productivity?

Changes in the university administration have also generated concern throughout our faculty. In the past we have enjoyed considerable support from the university president on downwards. We again feel that we are in a 'defensive' position only this time in our dealings with the university administration. It is obvious that the administration considers us a significant reservoir of funds through our overhead earnings. Our concern is that the combination of reduced federal funding on the one hand, and increased overhead costs, on the other hand, will seriously jeopardize our ability to remain one of the leading academic programs in atmospheric science in the world.

In summary, during my seven year tenure in the Department of Atmospheric Science, I have seen only subtle changes in the overall philosophy of the faculty and the student body. Considering the recent political-economic environment, this department has done better than most academic departments in withstanding the pressures which they are encountering. Given strong support from the university administration, this department should continue to remain one of the leading academic programs in atmospheric science.

10. HOW I CAME TO CSU

by

Wayne Schubert

I have been asked by Bill Gray to explain how and why I came to CSU almost nine years ago. Bill has suggested that perhaps I just didn't know any better but this is probably not the case. In 1971-1972 I was a graduate student at UCLA working with Akio Arakawa on cumulus parameterization. In the summer of 1972 a workshop on cumulus parameterization and the upcoming GATE was held at NCAR. There I met several people from CSU. After the workshop Bill Gray invited Arakawa, Yanai and myself to come up to Fort Collins for a visit. After five days of heated discussion in Boulder we spent an additional day at the Department arguing the details of parameterization. That night Nancy Gray fixed one of her outstanding dinners. We were all too numb to speak after so much scientific debate. Nancy commented that we were a weird bunch, a point of view to which she has converted my wife, although Karen claims she reached this conclusion independently. After dinner we went for a walk around City Park Lake, which left a lasting impression as to the beauty of this city.

In the fall of 1972 CSU was looking for a new faculty member in dynamics. Through my contact with Yanai and his contact with Gray, I applied, even though eight months of work lay ahead before completion of the Ph.D. I was invited to give a seminar in November 1972. One thing I remember about the seminar was that it was well-attended because Tom McKee used a plastic trumpet to remind people to attend. After the seminar and Department visit, Elmar took Karen and I to dinner. That night Karen asked me how the day went. I said there was only one thing bothering me. Why would a well known scientist and Department Head like Elmar Reiter drive a car with flames painted on the sides? My wife, who is much more observant than I, replied that these were not flames but were factory equipped wings painted on the sides of a four-wheel drive Eagle.

A job offer from CSU came around Christmas 1972 and I began work in the Fall of 1973. It has been a very enjoyable nine years. I believe a graduate academic program with each faculty member actively engaged in research is an ideal setting in which to work.

11. PERCEPTIONS OF CSU DEPARTMENT OF ATMOSPHERIC SCIENCE 1978-1982

by

Duane E. Stevens

Before arriving in 1978, I viewed the Department as primarily oriented towards the observational aspects of Atmospheric Science. Examples that spring to mind are the BOMEX radiation data; the many blue books containing data compilations and interpretations from Professor Gray's projects on tropical meteorology (known widely among journal editors as the Gray literature); the earth radiation budget studies; and the extensive departmental participation in the GATE experiment.

That view has been reinforced since 1978. The members of the Department have taken active roles in MONEX, FGGE, HIPLEX, PROFS, CCOPE, winter orographic cloud experiments, and no doubt other experimental programs as well. The megabits of data processed continuously by the satellite ground receiving station provide a steady reminder of the enormous volume of atmospheric data available.

Unlike most departments at CSU, our efforts are focused on graduate education and scientific research. Obtaining the funds necessary to generate and maintain that research program is one of the more frustrating and time-consuming, apparently unproductive aspects of working in the Department. However, learning together with the graduate students and research associates supported by those research dollars is a very rewarding component. Of considerable importance to the success of the Department is the high level of interaction among the faculty, providing a cohesion and unity of purpose to our efforts.

12. A SHORT-TERM HISTORICAL PERSPECTIVE

by

Richard H. Johnson

A span of residence of two and one-half years is not a sufficient length of time to establish a complete and accurate perspective of the evolution of our Department, nor is it too long to erase memories of impressions that existed prior to arriving here. It is perhaps the latter or 'outsiders' perspective that I might be able to contribute to most in our attempt at an evaluation of the history of the Department of Atmospheric Science.

The following is a brief account involving people and places, but these are what impressions are made of. It features Bill Gray, and justifiably so, because he has won the recognition of many in our field.

Traditionally, the Department has long been known for its strength in analysis and interpretation of observations. There is usually a good mix of theory with observations. No one recognizes the importance of both more than Bill Gray, yet Bill has been known at conferences to use a clever ploy to inspire maximum interchange between theoreticians and observationalists by pitting one side against another.

An episode at the GATE Seminar at Woods Hole during the summer of 1979 serves as a good example. I can safely say that the exchange there left a lasting impression on an audience of theoreticians and observationalists.

Following the presentation of a figure contrasting the thinking capacity of theoreticians and observationalists (which Jule Charney in equally good taste later used in a rebuttal statement), Bill presented another figure delineating the contrasting approaches to science by individuals in the two groups. As I remember it, the essence of Bill's message was that only the observationalist's approach could lead to true progress in science. Endearing himself to the theoreticians, Bill stated that their approach to scientific problems was characterized by circular reasoning. He may not have won the hearts of the theoreticians in the house, but probably won their attention for the remainder of his observational talk - a worthy goal.

The above episode and ensuing exchanges typify, I believe, the Department's recognition of the importance of a proper blend of observations with theory as being a vital part to real progress in science.

13. ONE PERSONAL PERSPECTIVE OF THE HISTORY OF THE DEPARTMENT

by

Roger A. Pielke

Having joined the faculty in late January of 1982, I can only provide a recent insider's perspective to the Department of Atmospheric Science. I can, however, describe what I feel is an excellent Department as well as explain why I desired to join the program.

One source of opinion regarding an academic research program is derived from the quality of students produced. During the past ten years or so, I have had many opportunities to talk with and to evaluate the work of M.S. and Ph.D. graduates from the Department. These graduates have advanced to professional positions at major University atmospheric science programs and at government laboratories. They have also been the recipients of major scientific awards. The quality of the research which they have produced as a direct result of their tutelage at CSU, has been crucial, in my opinion, at continuing to bring in new, high caliber graduate students.

A second means of evaluating a Department concerns its facilities and resources. By having its own building, it has been possible to focus personnel in order to maximize the interaction among the faculty, research associates, staff and students. It also provides a well-defined identity for the members of the Department. This camaraderie facilitates research studies, as well as provides an enjoyable work setting.

The advanced technological facilities of the Department also is a strong quality. The satellite receiving system, including the VAX computer, for example, offers many opportunities for innovative research which should only grow in the future. The Department computer terminal link, particularly to NCAR, is an example of how the concentration of resources can affect relatively economical solutions to logistics problems. The presence of the Office of State Climatologist and the NWS NESS group adjacent to and associated with the Department offer other examples of this focusing of skills and materials. At the University level, the procurement of the CYBER 205, with its vector processing capability, provides an anticipated opportunity to perform original, world-class research in meteorological modelling at all scales. Within Colorado, the presence of NCAR and the ERL labs with their continuing liason with the CSU program provides a larger scale example of this concentration of resources, which has been used constructively by the Department.

Another gauge of a program, and perhaps the most critical, is the quality of the faculty and its Department leadership. Such a group must not only be acknowledged experts in their field of specialty, but they

must be able to work together for the common goal of maintaining and improving the program. As I met and/or became aware of the work of faculty members within the Department (both during and before their employment at CSU), I realized that this quality was a common trait within the program. Such positive qualities extend to the adjunct faculty of the Department, as well. Moreover, as viewed from the outside, this highly talented group was being effectively lead by its Chairman.

Finally, during my occasional visits to Fort Collins, I was continually impressed by the positive attitude, apparently at all levels, towards research and graduate education. At both the Department and University levels, for example, the management staff appeared to be very supportive of research, and was effective at minimizing unnecessary bureaucratic burdens to the scientific investigators.

Last summer, I realized that the Department, College and University of which I was a member did not have any of these attributes with regards to an atmospheric science program. Despite the attempts of a few high quality scientists to change this condition, the effort was futile. When I realized that an improvement in the attitude toward research and graduate academic education was highly unlikely, I began to consider where and into which programs I would like to join, if I had the opportunity. Such a program had to emphasize those qualities of education which I felt were lacking in my former institute.

My first choice, for the reasons outlined earlier in this summary, was the Department of Atmospheric Science at CSU. Having been here for five months, I am convinced that my decision was correct.

14. THE SECOND DECADE AND FUTURE OF THE DEPARTMENT OF ATMOSPHERIC SCIENCE

by

Thomas H. Vonder Haar

On the occasion of our Twentieth Anniversary of the Department, we look back with appreciation and thanks to the founding fathers of the Department and to the many students, staff and faculty who have contributed so much to the Department. Of equal importance at this time is a pause to reflect upon the history and to take from it the lessons that we need to move ahead during our next twenty years. My recollections and comments will range from early impressions of the Department as an assistant professor through some ideas and visions that I have of the years to come.

Early 1970's

After arriving in 1970 and spending a year or so as an assistant professor, I was repeatedly amazed at the maturity of this Department even though it was only 8 years old on paper. Thanks to the experience and guidance of Herb Riehl, Elmar Reiter, Lew Grant and others the Department had already, at this relatively early age, taken its place in the hierarchy of major graduate level departments of atmospheric science in the US. Things were changing rapidly and I was dismayed to find that shortly after my arrival, Herb Riehl announced his departure for the Free University of Berlin to take on new challenges and research areas of interest. I had been attracted to Colorado State University because of the possibility of working with Herb and other faculty in accordance with the tradition of inter-faculty research collaboration that has become a hallmark of the Department. I also recall following Ferd Baer down the stairs, trying to convince him to remain at CSU with his spectral model. Ferd, of course, has gone on to a very successful scientific (and now administrative) career at the universities of Michigan and Maryland.

Indeed, the early 1970's were a time of great change throughout our science. Some recall the 60's as the boom-time years, but opportunities abounded for atmospheric scientists in the 1970's as well. In addition to the upsurge of interest and concern about air quality and its related scientific problems we were into an age of exciting international meteorological research activities born on the arms of new computer and satellite technology. Scientists such as Charney, Suomi, Smagorinsky and Kuettner were leading groups of old and young atmospheric scientists on collective projects such as the Global Weather Experiments, the GATE experiment and the still-underway World Climate Program. The impact of these research activities is yet to be fully realized in our community.

In this setting of the early 1970's, I recall my first impressions of Fort Collins and the Department of Atmospheric Science. I arrived for an interview in 1970 on one of those enchanting late winter days in Fort Collins after a fresh snowfall and under a warm sun. My friend and

research collaborator from Wisconsin, Steve Cox, had arrived a few months earlier and he introduced me to the faculty. They immediately proved their collective persuasive skills by tricking me into my first bowl of green chile at the El Burrito Restaurant. Later in the day Professor Reiter, the Department Head, and I were busily laying out the conceptual framework and a few details of a research project on which we might collaborate should I receive an opportunity to join the faculty. Near the end of the discussion, I was at first startled and then impressed by Elmar's energy when he pivoted to his typewriter and immediately began typing the first draft of our joint proposal to NASA! For a young Ph.D. with strong research inclinations, the mix of teaching and research offered at Colorado State University was much to my liking and I was happy to join the faculty and continue my collaboration with Steve Cox.

A few years later, having endured the humbling experience of retrospective review of my first semesters in the classroom and full of questions that all young faculty have in their minds regarding how things get done and decided, I suggested to Elmar that we have a faculty retreat modelled on corporate-style retreats. Here we thought some of the complex issues regarding faculty and Department policies, curriculum, and examinations, etc. could be discussed in an informal atmosphere. I recognize now the tolerance and open-mindedness of the senior faculty and the Department Head in accepting this idea which was very popular among the younger members of our Faculty group. These retreats have become an annual event and now I find myself in the position of one of the 'graybeards' discussing many of the same questions with Duane Stevens, Dick Pearson, and Dick Johnson. In such ways, I presume universities, faculties and departments bring in new ideas, reshape the old ones and carry on for years and years.

Following the departure of Herb Riehl and Ferd Baer, we were all most enthusiastic when Professor Bernhard Haurwitz began teaching at an increasing pace at CSU. He brought his expertise not only into the advanced graduate program, but also began teaching the basic dynamics course in the Department. At about this time a young postdoc from Imperial College, Alan Betts, won a position as a tenured faculty member. Alan's contributions are specially noted in another section of this history. Wayne Schubert joined us from UCLA as a numerical modeler, and Helen Poland from Indiana State, as a new member of our atmospheric chemistry program. Wayne initially teamed with Professor Haurwitz in the dynamics teaching program and after spending time on a ship during the 1974 GATE experiment, has been known to mix his theoretical meteorology and numerical modelling research with regular appearances in field programs. He was even seen crawling under airplanes to adjust instruments during a 1980 experiment with Pete Sinclair, Ed Hindman, and myself. Helen's interest in chemistry was soon surpassed by her interest in her fine horses and she has since changed careers and completed a program in veterinary medicine.

One of the large international field programs, the GARP Atlantic Tropical Experiment (GATE) lured away (temporarily, we thought) one of our finest teachers, Jim Rasmussen in 1973. He did so well in organizing and guiding programs of this kind that he has continued as an

administrator/scientist with the World Meteorological Organization and the National Oceanic and Atmospheric Administration.

In the early 1970's we were also joined by Mr. Willis (Slim) Somervell, Jr., hired by Professor Reiter to be our first Department Manager. After a period of re-programming of Slim from the military to university life, his energetic contributions to the Department and his enthusiasm were appreciated by all concerned. Slim continued with the Department in a research capacity. He worked with Prof. Reiter and participated with him on some very interesting projects before he was asked by Dean Baldwin to manage the new and exciting programs of off-campus education sponsored by the College of Engineering.

Mid 1970's

Recollections of the mid-1970's begin with the day in 1973 when I sat with the other faculty in our conference room and heard Elmar Reiter's decision to return to full-time teaching and research. It was in the aftermath of that shock that I recognized once again the very strong personal commitment I had to the Department and to the belief that it was definitely well-conceived and well-directed. As much to preserve what I believed to be a fine Department for the faculty, the students and myself, I threw my hat into the Department Head ring. By mid-1974 I had officially taken on the headship of a Department so well on its way to success.

The Department's research continued to take the lead in national and international field programs in the mountains of Colorado and elsewhere. Many of our faculty and students participated in the 1974 GARP Atlantic Tropical Experiment (GATE). Even Tom McKee who had graduated from CSU and was a professor at the University of Virginia, was involved in the GATE just before we hired him to join our faculty and also serve as the first new Colorado State Climatologist. Bill Cotton was in GATE also. His work was well-known to many of us and when an opportunity arose in 1974, Bill was invited to join our faculty. As a new Department Head, there was some concern among the faculty as to how I made the decision to choose Bill Cotton over the impressive slate of applicants who wished to join us at that time. While controversy may continue over how the decision was made, no one doubts 'our' collective wisdom in inviting both McKee and Cotton to join our Department in the 1974-75 academic year.

Much of our activity and success during this period was due to the excellent support staff, many of whom had been with the Department from its early days. An increasingly important role was being played as well by our research faculty, including such research associates as Glen Brier, Eric Smith, Greg Tripoli and others. Our entire program was strengthened with the addition of Mr. Dave Cismoski who became our second Department Manager in 1975-76. Dave arrived with experience in university research administration at the University of Wisconsin. He participated in the growth and refurbishment of many of the Department laboratory facilities and the establishment of our satellite ground station for teaching and research. Dave left the Department in June, 1978 and took a position as the Assistant to the Director of the

Colorado State University Experiment Station and is now Comptroller of the Research Institute of Colorado.

Thus, we all enjoyed the mid 1970's with a full complement of faculty and an excellent group of graduate students. The Department flourished because of its flexibility and commitment to excellence of research and graduate education. We began to see some of our early Ph.D. students such as Mahlman, Bean, Solomonson, Rasmussen, Elsberry and others move into positions of respect and responsibility in our field. This indeed was the first proof that the Department's ultimate purpose, namely the education of students, was bearing very fine fruit.

Digression 1

We can't say too much about students in this history of the Department. Lists are important, yet bland. Numbers of degrees are impressive, but sterile. The participation and collaboration of our graduate students, ranging from Air Force officers through foreign visitors, from the bright young physicists to the experienced weather forecasters simply cannot be overstated. We all know that a curriculum evolves as much by student excitement and interest as by faculty wisdom. We know that the enthusiasm of our field programs and new computer processing activities is fostered by our students and staff as much as by faculty innovation. It has been a characteristic of the Department to keep its ear open to the students, individually and collectively. For this purpose, among others, Professor Elmar Reiter established the participation of student representatives at our Department faculty meetings.

Since one of the hallmarks of our Department has been its observational orientation, I believe our students are of that group which learn a great deal more than the basics during their Master of Science or Doctor of Philosophy program in Atmospheric Science. In the Department, we bring in the math whiz kids and help them realize the practicalities and joys of field work. Laboratory gadgeteers are enticed into classes on wave dynamics. Senior students are introduced to the joys of proposals and contract reports. All in all, our students learn a tremendous amount outside the classroom to help them in their career. The teachers are not only the faculty, but also our staff, including secretaries, and the complement of research faculty and associates that collaborate with us as full-fledged partners in our research activities.

Digression 2

By the late 1970's, after 15 years, two guiding principles were well recognized to shape Department policies, plans and procedures. The first, that the purpose of a university is to educate students had been burned into my thinking as both a student and a postdoctoral fellow working with Professor Verner Suomi. The second, that the research principal investigator is 'King' evolved at CSU from a realization that the heart and strength of the Department was in its faculty-led graduate research programs. These strong, front-line competitive programs have research peer recognition and good support from the science program

managers in Washington, DC and elsewhere. They lead the way in our science, with support and occasional guidance from the Department administration. (This second principle is a radical change from the approach Professor Riehl necessarily used to begin the Department.)

And so, as a Professor, Department Head and active scientist guided by the two principles, it was and is easy to see and enjoy the harmony between my administrative, research and educational responsibilities. This harmony is expressed to the Department as firm guidance from the Head while depending on the individual and collective strengths of the faculty for final success.

Late 1970's and Early 1980's

We were happy to have Duane Stevens join us from a post-doctoral year at the University of Washington after his graduation from Harvard. Duane allowed Professor Haurwitz to step back a bit from his teaching pace. He also showed his eagerness for research with many of the faculty. Alan Betts who had joined us in the early 1970's and whose excellence in research was recognized by many decided to change his career and lifestyle. He left our Department to take up a position that would give him more flexibility in pursuing some of his scientific and humanistic ideas. We are happy that Alan visits the Department at least once each year, and that he is doing so well in his chosen areas.

Faced as we were with replacing Alan, and with the realization that another 'mainline' atmospheric scientist was needed, I recalled the advice Vern Suomi had given me when I undertook the Department Head activity. He said that a "Department Head's primary contribution will always be in the quality of the faculty they recruit and select and help through the early years of their professional careers". We had all been enjoying the productivity and collegiality of McKee and Cotton, and Stevens was looking better every day. The Department had enjoyed an infusion of new blood, but we needed more because Betts was leaving and Professor Myron 'Mike' Corrin was approaching retirement. (Mike, the best teacher in the Department, made many contributions which are found in another section of this history.)

After a rather lengthy search, two new faculty members, Dr. Richard Johnson and Dr. Richard Pearson Jr. joined us in late 1979 and early 1981, respectively. Both gentlemen had extensive postdoctoral experience: Dick Johnson in research and teaching in mesoscale and synoptic meteorology; and Dick Pearson in physical chemistry and air quality research. Impressed with the enthusiasm and energy of these new faculty and determined to strengthen our Department in the rapidly emerging area of mesoscale numerical modeling I launched a search for yet another new faculty member. Bill Cotton brought word that Dr. Roger Pielke was interested in our Department and after the overall search was completed in late 1981, Roger joined our faculty. Dean Lionel Baldwin was particularly helpful to the Department as we added this new faculty position in our 20th year.

Of course our continuing stream of research associates continued to aid the Department during long and short terms. In the late 1970's Dr.

William Finnegan and Dr. Edward Hindman Jr. were notable additions. Dave Cismoski's replacement in 1978 as Department Manager was Walt Naylor, a home-grown graduate of CSU with many years of experience with Western Scientific, a small company that was originally an outgrowth of the Department. Walt continues to serve as our Department Manager and has been responsible for much of the staff work that has been required to keep up with the rapidly changing and shifting sands of the early 1980's.

Before carrying this narrative too far into the 1980's and the future, we should point out that some extremely significant events took place during the mid and late 1970's. The age of distributed computing came upon us through the link of the Department to very large computers such as the CRAY-1 at the National Center for Atmospheric Research in Boulder. Many computers began appearing as part of our field programs and on professor's desks. The entire new micro-electronics technological innovation began to impact meteorology, not only in the way we obtained our measurements but also in new and more improved ways to process the data. The Department entered the space age in the mid and late 1970's with the establishment of a very complex satellite ground station and man-computer interactive data processing capability. These new facilities were constructed in collaboration with Professor Tom Brubaker and colleagues from the Electrical Engineering Department. During this time, students in electrical engineering and atmospheric science began to work side by side in our building on theses and dissertations each in their own area, but with atmospheric science as common theme.

Outside recognition of the Department's expertise and facilities related to a wide variety of scientific problems was also notable during the last few years. Several of our faculty and students received national awards and honors. Our graduates received good employment opportunities. Our research collaborations grew.

Under a cooperative arrangement fostered by Harold Yates and I, a group of five research scientists from the National Earth Satellite Service of NOAA arrived in Fort Collins lead by Jim Purdom. Shortly thereafter NOAA (with George Benton, Earl Droessler, Joe Fletcher, Yates and others working with us) broadened its collaboration with CSU and the Department by the establishment of the Cooperative Institute for Research in the Atmosphere (CIRA). I was named Director and the faculty and NOAA scientists have responded with enthusiastic collaboration.

In addition, the Colorado Climate Center under Tom McKee's guidance grew to reach a very large audience of weather and climate data users in the State of Colorado. Special requests for information from state agency groups, citizen groups and private industry have risen to nearly 1000 per month. Tom has been ably assisted by students and a staff that included Dr. John Benci and now Nolan Doesken as the Assistant State Climatologist. In addition to benefits to the state, our teaching and research programs are well served by the Colorado Climate Center. It has become a model activity for other states.

The Future

The economic picture in the US and the post-Watergate era have combined to bring difficult times upon big science and scientific education in the US. The Department has weathered most of the storm thus far, but the sailing ahead is undoubtedly going to be a bit turbulent. We are fortunate to have the strong and energetic core of associate and full professors to help us move as a Department through the period at hand. However, there is no question that even through the second half of the 1970's, we were not able to prosper as we did by using the same methods and approaches as the Department had used during its first ten years. Innovations of the recent past included the establishment of a Cooperative Institute for Research in the Atmosphere with NOAA and the Colorado Climate Center. In addition, new activities with research institutes such as the Research Institute of Colorado and others were established. It has been and is a time for the scientist, science administrator and graduate student to obtain the most 'science per dollar'. These new mechanisms help us to do so. We are also fortunate that we have an array of facilities, equipment and computers to choose from in addressing a particular scientific problem. We have an abundance of data sets that were acquired during the period of national and international field programs of the 1970's.

During the second decade of the Department's history, we have many colleagues and associates around the country in the National Science Foundation and many other supportive government and state groups to thank wholeheartedly for their support and assistance to our Department. We have formed many lasting collaborations and friendships which have been born in scientific discussions and experiments. We are happy that many of these friends and colleagues will be with us at our Twentieth Anniversary to look back a bit and also ahead with us. We now have a moderately senior group of Ph.D. graduates from the Department whom we believe will play an ever increasing role in our science and also contribute each in their own way to the Department's continued development.

We certainly do not foresee major growth in numbers, space or activity but recognize that to maintain the position we seek on the frontiers of our science, continued changes are both necessary and to be desired. We have benefited greatly in the first twenty years from the support of the administration at Colorado State University, especially from former President A. R. Chamberlain and Vice President for Research George Olson. Dean Lionel Baldwin and Associate Dean Daryl Simons of the College of Engineering have had the wisdom to allow this small group of atmospheric scientists to forge the Department free from unnecessary constraints. A mixture of this positive and passive support from the CSU administration is going to be a critical ingredient during the 1980's for Departments like ours and other strong ones across the country in many disciplines. It is a difficult time for Universities and hard decisions have to be made between the maintenance of strong programs that have taken many years to build to excellence and the development of other aspects of the university community. We need strong support now from the new CSU administration of President Ralph

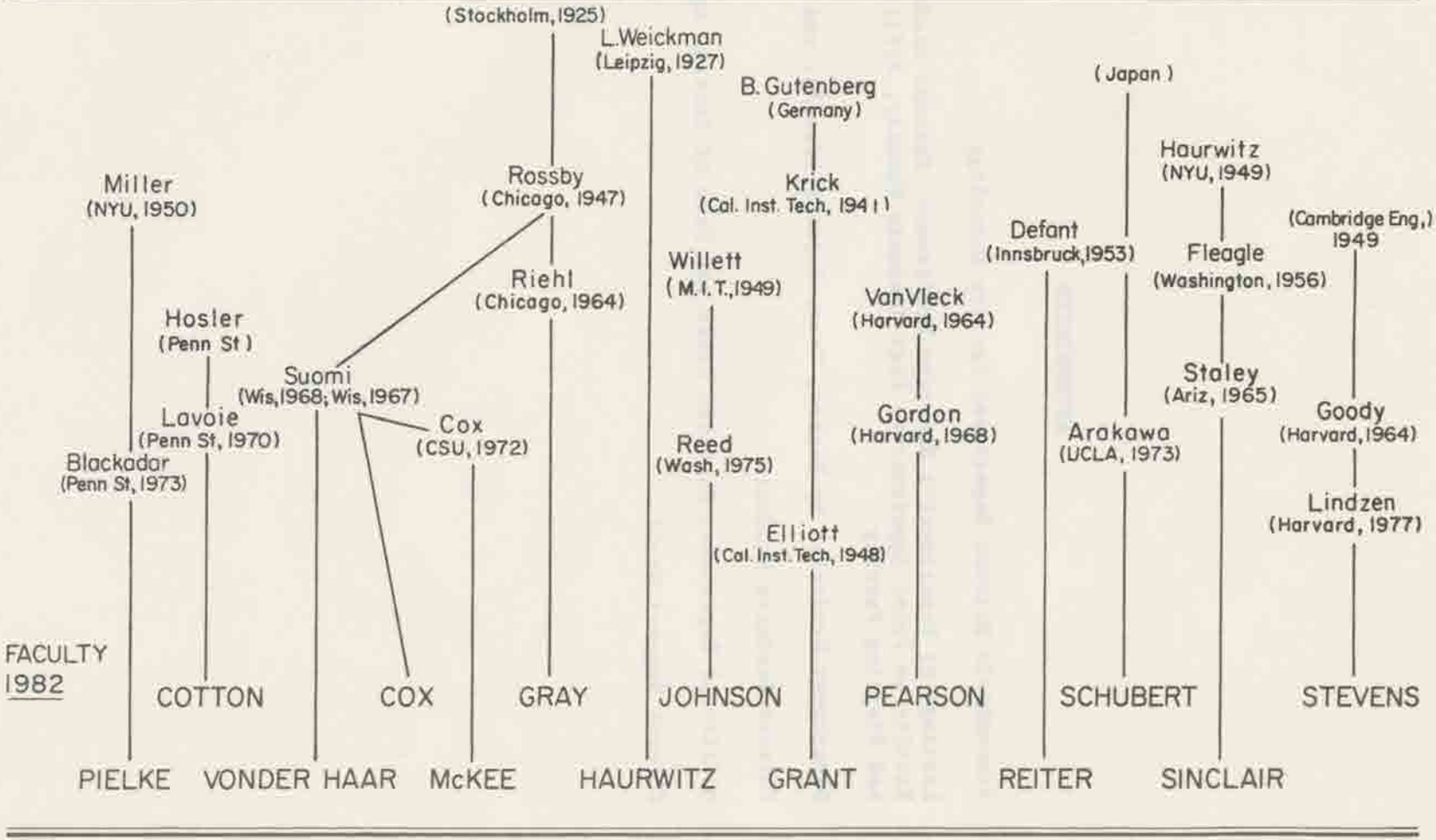
Christofferson and Executive Vice-President Rebecca Stafford. The recognition, and indeed the eager welcome of graduates from our Department into the university, federal, state and private working place is all the evidence we need to demonstrate that our program is not only strong, viable and healthy for the faculty and students who populate it, but also for the society for whom we train these students. The 1980's and the next 20 years of the Department will require the same flexibility and ability to move between the conceptual and practical aspects of science that we have enjoyed during the Department's first two decades.

So now with a faculty of 13 augmented by Professor Haurwitz, and with a graduate student population targeted to remain nearly constant at 70-75 full-time students, we move into the 1980's with optimism and enthusiasm. The fact that we have chosen to celebrate our Twentieth Anniversary in 1982 with a reunion, open house and scientific symposium is evidence of the strength of our program and the guarded optimism with which we face the future. There is no better way to recognize this Department's preparation and commitment to excellence for its next two decades than to review our present day scientific facilities and individual research project results and plans. Many of these are displayed at the open house and will be discussed during our participation in the scientific sessions held as part of our Twentieth Anniversary celebration.

APPENDICIES

1. Atmospheric Science Department Faculty Genealogy
2. Listings of Department's Emeritus Professors, Current Academic Faculty, Faculty on Joint Appointment, Past Academic Faculty, Affiliate Faculty, and Visiting Faculty
3. Department Graduates by Degree, Year, Major Professor, and Thesis Title
4. Current Graduate Students
5. Additional Department Research Staff and Date of Initial Appointment
6. Current Support Staff

ATMOSPHERIC SCIENCE DEPARTMENT
FACULTY GENEALOGY



EMERITUS PROFESSORS

Dr. Myron Corrin	1967 - 1980	*(Deceased)*
Dr. Herbert Riehl	1960 - 1972	*(Retired)* *(First Department Head)*

CURRENT ACADEMIC FACULTY

Dr. William R. Cotton	1974 -	
Dr. Stephen K. Cox	1969 -	
Professor Lewis O. Grant	1959 -	
Dr. William M. Gray	1961 -	
Dr. Bernhard Haurwitz	1975 -	
Dr. Richard H. Johnson	1980 -	
Dr. Thomas B. McKee	1974 -	
Dr. Richard Pearson, Jr.	1980 -	
Dr. Roger A. Pielke	1981 -	
Dr. Elmar R. Reiter	1961 -	*Former Department Head*
Dr. Wayne Schubert	1973 -	
Dr. Peter C. Sinclair	1965 -	
Dr. Duane E. Stevens	1978 -	
Dr. Thomas H. Vonder Haar	1970 -	*Department Head*

FACULTY ON JOINT APPOINTMENT

Dr. Paul Mielke	1969 -	*Statistics Department*

PAST ACADEMIC FACULTY

Dr. Ferdinand Baer	1961 - 1972	
Dr. Alan Betts	1970 - 1979	
Dr. Helen Poland	1973 - 1976	
Dr. D. B. Rao	1968 - 1971	
Dr. James L. Rasmussen	1969 - 1972	
Dr. Herbert Riehl	1960 - 1972	*Former Department Head*

AFFILIATE FACULTY

Dr. Earl Barrett	1969 - 1970
Dr. John M. Brown	1979 -
Dr. Thomas Brubaker	1979 -
Dr. Paul J. Crutzen	1977 - 1982
Dr. Robert E. Dickinson	1980 - 1981
Dr. O. M. Essenwanger	1969 - 1972
Dr. William O. Finnegan	1982 -
Dr. Rogert M. Gallet	1969 - 1973
Dr. Freeman Hall	1976 - 1977
Dr. Gottfried Hanel	1981 -
Dr. Peter Hildebrand	1980 -
Dr. Donald Lenschow	1972 -
Dr. Donald Klein	1979 - 1980
Dr. Harold Orville	1980 -
Dr. Takeshi Ohtake	1969 - 1971
Dr. Kenneth Rahn	1980 -
Dr. Herbert Riehl	1982 -
Dr. M. Siddiqui	1978 - 1981
Dr. Joanne Simpson	1980 - 1981
Dr. Freeman Smith	1980 - 1981
Dr. Edward Zipser	1980 -

VISITING FACULTY

Dr. Edward M. Brooks	1981 -
Mr. Lian-Shou Chen	1982 -
Dr. Charles Chappell	1967 - 1974
Dr. Abraham Gagin	1970 - 1975
Dr. R. G. Knollenberg	1973 - 1974
Dr. B. E. McClellan	1977 - 1978
Dr. Hans Panofsky	1982 -
Dr. Willie Webb	1970 - 1971
Mr. Jianmin Xu	1980 - 1982

Department of Atmospheric Science

ALUMNI

Major Professor	Student	Degree	Year	Thesis Title
Prof. Ferdinand Baer	Fred Nelson Alyea	Ph.D.	1972	Numerical Simulation of an Ice Age Paleoclimate
	William Russell Burrows	Ph.D.	1975	A Spectral Diagnostic Study of Atmospheric Kinetic Energetics
	Nagaswamy Ramanathan	M.S.	1971	A Study of the Nongeostrophic Barotropic-Baroclinic Instability Problem
	Theodorus Johannes Simons	Ph.D.	1970	The Nonlinear Dynamics of Cyclone Waves
Prof. Alan Betts	Luis Alberto Cruz	M.S.	1972	Venezuelan Rainstorms as Seen by Radar
	Frank J. Dugan	M.S.	1973	Convective Changes in Heat and Moisture Structure of the Cumulus Sub-Cloud Layer
	Ralph Wayne Grover	M.S.	1974	Characteristics of Tropical Squall-Lines Over Land
	Martha Luis Mata	M.S.	1972	Modeling Venezuelan Weather Systems
	Alan J. McNab	Ph.D.	1976	Mesoscale Characteristics of Cumulus Convection
	Douglas Alan Moore	M.S.	1974	Diagnostic Tests of Models for the Thermal Structure of the Non-Precipitating Convective Boundary Layer
	Richard Neil Mower	M.S.	1977	Case Study of Convection Lines During GATE
	Omar Jesus Rodriguez Ruiz	M.S.	1975	Mesoscale Studies of the Tropical Sub-Cloud Layer
	Maria F. Silva Dias	M.S.	1977	Diagnostic Analysis of Tropical Cumulonimbus Downdraft Structure
Senior Research Associate Glenn Brier	Patrick Allen Harr	M.S.	1978	Relationships Between Precipitation, Pressure and Ocean Temperature

Major Professor	Student	Degree	Year	Thesis Title
Prof. Myron Corrin	William R. Barchet	M.S.	1968	The Sessile Drop as a Heterogeneous Nucleation Embryo
		Ph.D.	1971	The Interaction Between Water Vapor and Pure Silver Iodide in the Vicinity of Saturation
	Ray Malcolm Barnes	M.S.	1976	In Situ Coated Silver Iodide Nucleants
	Mark Vincent Carney	M.S.	1977	An Analytical Technique for the Analysis of Atmospheric Lead Alkyls
	Ted S. Cress	M.S.	1970	
	David Adrian Dahl	M.S.	1973	The Washout of Atmospheric Lead
	Hermann Ernst Gerber	Ph.D.	1973	Freezing Water with Sized AgI Particles
	Robert Stephen Haines	M.S.	1974	Poisoning of Silver Iodide Ice-Nucleants
	Douglas Clayton Hunt	M.S.	1976	
	Gregory Lewis Logan	M.S.	1974	
	Gray Brent McWilliams	M.S.	1976	
	Bernard George Mendonca	M.S.	1975	Benchmark Properties of Atmospheric Aerosols
	Gerald Harvey Mueller	M.S.	1974	
	Donald Wayne Nelson	M.S.	1973	PPM Level Gas-Particulate Interactions
	John D. Sheaffer	M.S.	1972	Water Vapor Adsorption on Lithium Doped Silver Iodide
	Steven Vardiman	M.S.	1977	The Amine Inhibition of AgI Aerosol Ice Nucleation
	Phillip L. Youngblood	M.S.	1974	
Prof. William Cotton	Robert M. Banta	M.S.	1975	On Determining Vertical Wind Velocities from EOLE Constant Density Balloon Data
	Raymond L. George	M.S.	1979	Evolution of Mesoscale Convective Systems Over Mountainous Terrain
	David C. Hahn	M.S.	1980	Observed Characteristics of Turbulence in the Atmospheric Boundary Layer Over Mountainous Terrain

Major Professor	Student	Degree	Year	Thesis Title
Prof. William Cotton	Richard L. Hughes	M.S.	1978	A Numerical Simulation of Mesoscale Flow Over Mountainous Terrain
	Kevin R. Knupp	M.S.	1980	Observed Characteristics of an Intense Quasi-Stationary Thunderstorm Complex Over Mountainous Terrain
	Thomas Nehrkorn	M.S.	1980	A Three-Dimensional Simulation of the Dynamic Response of a Florida Cumulus to Seeding
	Mark A. Stephens	M.S.	1979	A Simple Ice Phase Parameterization
	Frederick Toepfer	M.S.	1978	An Evaluation of a Second Moment Time Dependent Turbulence Model
	Peter J. Wetzel	Ph.D.	1978	A Detailed Parameterization of the Atmospheric Boundary Layer
Prof. Stephen Cox	Michael D. Abel	Ph.D.	1980	A Climate Index Derived from Satellite Measured Spectral Infrared Radiation
	Steven A. Ackerman	M.S.	1979	Gate Phase III Mean Synoptic-Scale Radiative Convergence Profiles
	Bruce A. Albrecht	M.S.	1974	The Large Scale Heating Response of the Tropical Atmosphere with Radiative Heating
		Ph.D.	1977	A Time Dependent Model of the Trade-Wind Boundary Layer
	Guillermo F. Almeyda	M.S.	1972	Surface Energy and Water Budget Over Grassland
	Gregory P. Byrd	M.S.	1980	A Case Study of Radiative Forcing Upon a Tropical Cloud Cluster
	John M. Davis	M.S.	1977	Solar Absorption in Clouds of Finite Horizontal Extent
		Ph.D.	1981	Regional Properties of Angular Reflectance Models
	Rae Eversole-Dougherty	M.S.	1979	Spectral Characteristics of Boundary Layer Turbulence Over Irregular Terrain
	James R. Fleming	M.S.	1973	Radiative Effects of Cirrus Clouds

Major Professor	Student	Degree	Year	Thesis Title
Prof. Stephen Cox	Keith T. Griffith	M.S.	1977	Radiative Properties of Clouds Inferred from Broadband Measurements
	Kenneth E. Heikes	M.S.	1971	Steady Convection of Stratified Fluid
	Marie S. Kuo	M.S.	1975	Precipitation Trend and Storm Analysis
	Thomas B. McKee	Ph.D.	1971	Inference of Stratospheric Temperature and Water Vapor Structure from Limb Radiance Profiles
	Christopher P. Mendola	M.S.	1978	Cloud Analysis from Bi-Spectral Satellite Data
	Patrick Minnis	M.S.	1978	Magnitude of the Radiative Effects of the Saharan Dust Layer
	Michael R. Poellott	M.S.	1975	Computer Simulation of Irradiance Measurements from Aircraft
	Anthony A. Rockwood	M.S.	1976	Satellite Inferred Albedo Over Northwestern Africa
	David C. Starr	M.S.	1976	Objective Cloud Field Determinations for the GATE
	Thayne M. Thompson	M.S.	1980	Pyrheliometer Observations as an Indicator of the Climatological Persistence of Clouds
	Charles P. Turner	M.S.	1973	
Prof. Lewis Grant	Mitchell T. Baer	M.S.	1978	Aerial Sampling of a Weather Modification Seeding Agent
	Daniel W. Breed	M.S.	1979	Liquid Water Measurements in High Elevation Continential Cumuli
	Stanley R. Brown	M.S.	1978	Terminal Velocities of Ice Crystals
	Calvin C. Butler	M.S.	1966	

Major Professor	Student	Degree	Year	Thesis Title
Prof. Lewis Grant	Charles F. Chappell	M.S.	1968	Cloud Seeding Opportunity Recognition
		Ph.D.	1971	Modification of Cold Orographic Clouds
	Kelvin S. Danielson	M.S.	1975	Continental Mountain Cumulus Clouds
	Robert J. Dumont	M.S.	1975	Determining the Seedability of the Winter Orographic Cloud from Satellite Observations
	Richard Durham	M.S.	1973	Warm Cumulus Cloud Seeding Potential
	Russell E. Erbes	M.S.	1978	A Kinematic Description of Colorado Thunderstorms
	J. Michael Fritsch	Ph.D.	1978	Parameterization of Mid-Latitude Organized Convection
	Roland W. Furman	M.S.	1967	Radar Characteristics of Wintertime Storms in the Colorado Rockies
	Teizi Henmi	Ph.D.	1974	Secondary Ice Particle Production from Rimed Ice
	John F. Henz	M.S.	1974	Colorado High Plains Thunderstorm Systems
	Edward E. Hindman	M.S.	1967	Snow Crystal and Ice Nuclei Concentrations in Orographic Snowfall
	Lawrence M. Hjermstad	M.S.	1970	The Influence of Meteorological Parameters on the Distribution of Precipitation Across Central Colorado Mountains
	Don W. Janssen	M.S.	1975	
	Robert R. Lee	M.S.	1980	Winterimte Cloud Systems Over the Colorado Rockies: Three Case Studies
	David A. Matthews	M.S.	1971	Effects of Raindrop Spectra on a Cumulus Model
	Jonnie G. Medina	M.S.	1981	Techniques for Assessment of Nonrandomized Weather Modification Programs in the Colorado Mountains

Major Professor	Student	Degree	Year	Thesis Title
Prof. Lewis Grant	Gerald J. Mulvey	Ph.D.	1977	Physical Mechanisms of Extra Area Effects from Weather Modification
	John William Oliver	M.S.	1971	
	Matthew C. Pope	M.S.	1977	Management of Alpine Windblown Snow by Lee Slope Avalanche Modification
	William R. Puckett	M.S.	1973	
	Robert M. Rauber	M.S.	1981	Microphysical Processes in Two Stabley Stratified Orographic Cloud Systems
	John E. Reid	Ph.D.	1976	Dispersion in a Mountain Environment
	Roger F. Reinking	Ph.D.	1974	Emperical Assessment of Accretion Microphysics
	John O. Rhea	Ph.D.	1977	Orographic Precipitation Model for Hydrometeorological Use
	Ronald E. Rinehart	Ph.D.	1979	Internal Storm Motions from a Single Non-Doppler Weather Radar
	Richard Stodt	M.S.	1978	Summertime Satellite Cumulus Cloud Climatology
	Larry Vardiman	M.S.	1972	Ice Crystal Multiplication in Convective Elements of Winter Orographic Clouds
		Ph.D.	1974	The Generation of Secondary Ice Particles in Clouds by Crystal-Crystal Collision
	John C. Vimont	M.S.	1982	Snowpack Acidity in the Colorado Rocky Mountains
Prof. William Gray	John T. Anthony	M.S.	1969	
	Charles P. Arnold	Ph.D.	1977	Tropical Cyclone Cloud and Intensity Relationships
	Jean Marie Dewart	M.S.	1978	The Diurnal Variability of the Atmosphere in the GATE Region
	Kenneth M. Dropco	M.S.	1981	Tropical Cyclone Intensity Change: A Quantitative Forecasting Scheme

Major Professor	Student	Degree	Year	Thesis Title
Prof. William Gray	Steven L. Erickson	M.S.	1977	Comparison of Developing vs. Nondeveloping Tropical Disturbances
	William A. Fingerhut	Ph.D.	1980	Tropical Cyclone Genesis: Numerical Modeling Influences
	Gary S. Foltz	M.S.	1976	Diurnal Variation of the Tropospheric Energy
	William M. Frank	M.S.	1973	Characteristics of Carbon Black Dust on a Large-Scale Tropospheric Heat Source
		Ph.D.	1976	The Structure, Dynamics and Energetcs of Tropical Cyclones
	John E. George	M.S.	1976	Tropical Cyclone Motion and Surrounding Parameter Relationships
	Pamela G. Grube	M.S.	1979	Convection Induced Temperature Change in GATE
	Greg J. Holland	M.S.	1981	Angular Momentum Budgets in Tropical Cyclones
	Lee R. Hoxit	Ph.D.	1973	Variability of Planetary Boundary Layer Winds
	Robert W. Jacobson	M.S.	1975	Diurnal Variability of Cumulus Convection Over the Tropical Ocean
	Cheng-Shang Lee	M.S.	1981	Vertical Rearrangement of Tangential Momentum in Tropical Cyclones
	Raul E. Lopez	M.S.	1968	Investigation of the Importance of Cumulus Convection and Ventilation in Early Tropical Storm Development
		Ph.D.	1972	A Parameteric Model of Cumulus Convection
	Geoff B. Love	Ph.D.	1982	The Role of the General Circulation in Tropical Cyclone Genesis
	John L. McBride	Ph.D.	1979	Observational Analysis of Tropical Cyclone Formation
	Robert Maddox	M.S.	1973	A Study of Tornado Proximity Data and an Observationally Derived Model of Tornado Genesis
	Bruce R. Mendenhall	M.S.	1967	A Statistical Study of Frictional Wind Veering in the Planetary Boundary Layer

Major Professor	Student	Degree	Year	Thesis Title
Prof. William Gray	David J. Novlan	M.S.	1973	Hurricane Spawned Tornadoes
	Edwin Nunez	Ph.D.	1981	Tropical Cyclone Structure and Intensity Change
	Ronald W. Phelps	M.S.	1977	
	Radolpho P.L. Ramos	M.S.	1974	Precipitation Characteristics in the Northeast Brazil Dry Region
	James W. Sartor	M.S.	1968	Monthly Climatological Wind Fields Associated With Tropical Storm Genesis in the West Indies
	Dennis J. Shea	M.S.	1972	The Structure and Dynamics of the Hurricane's Inner Core Region
	Donald F. Wachtman	M.S.	1968	Role of Angular Momentum Transports in Tropical Storm Dissipation Over Tropical Oceans
	Gregg W. Walters	M.S.	1976	Severe Thunderstorm Wind Gusts
	Knox T. Williams	M.S.	1970	A Statistical Analysis of Satellite-Observed Trade Wind Cloud Clusters in the Western North Pacific
	Thomas G. Wills	M.S.	1969	Characteristics of the Tornado Environment as Deduced from Proximity Soundings
	Carl S. Zimmerman	M.S.	1969	
	Raymond M. Zehr	M.S.	1976	Typhoon Genesis and Pre-Typhoon Cloud Clusters
Prof. Bernhard Haurwitz	David E. McGuirk	M.S.	1977	
	David J. Wackter	M.S.	1976	The Structure of Atmospheric Parameters in Wavenumber-Space
Prof. William Marlatt	Alan C. Anderson	M.S.	1965	
	James D. Bergen	M.S.	1964	The Thermal Regime of a Mountain Snow Cover
		Ph.D.	1967	Some Aspects of Cold Air Drainage on a Forested Slope

Major Professor	Student	Degree	Year	Thesis Title
Prof. William Marlatt	Robert E. Black	M.S.	1968	A Synoptic Climatology of Blizzards on the North Central Plains of the United States
	Harold L. Cole	M.S.	1974	The Effect of Aerosols on Atmospheric Radiation
	James R. Connell	Ph.D.	1973	Entrainment by Turbulent Jets of Air
	William D. Ehrman	M.S.	1968	
	Robert L. Grossman	M.S.	1968	An Investigation of Water Surface Temperature by an Airborne Infrared Radiometer: Lake Hefner, Oklahoma
		Ph.D.	1973	An Aircraft Investigation ofTurbulence in the Lower Layers of a Marine Boundary Layer
	Yunn Pann	M.S.	1969	
	Warner K. Resser, Jr.	M.S.	1969	Haze Distributions in the Troposphere
	David S. Renne	M.S.	1969	Stability and Dynamic Processes in the Formation of High Plains Hailstorms
	Vincent V. Salomonson	Ph.D.	1968	Anistropy in Relfected Solar Radiation
	Peter S. Sandberg	M.S.	1971	
	Robert J. Sopka	M.S.	1970	Remote Infrared Detection of Uranium Ore Bodies
	Raymond T. Yeatman	M.S.	1968	
Prof. Thomas McKee	Robert L. Agne	M.S.	1978	
	Dave Bader	M.S.	1981	Simulation of the Daytime Boundary Layer Evolution in Deep Mountain Valleys
	Mark DeMaria	M.S.	1979	A Comparison of Theoretical and Observed Radiances from Non-Precipitating Cumulus Clouds
	Dave Ebel	M.S.	1981	Diurnal Radiance Pattern of Finite and Semi-infinite Clouds in Observations of Cloud Fields
	Malcolm D. Gifford	M.S.	1977	Characteristics Size Spectra of Cumulus Fields Observed from Satellites
	George R. Heuer	M.S.	1978	Predicting Winter Wheat Phenology Using Temperature and Photoperiod

Major Professor	Student	Degree	Year	Thesis Title
Prof. Thomas McKee	John T. Klehr	M.S.	1978	Simulated Radiance Patterns for MIE Absorbing Finite Clouds
	James A. Kuenning	M.S.	1978	A Laboratory Investigation of Radiative Transfer in Cloud Fields
	Roger L. Sorensen	M.S.	1981	Cloud and Insolation Climatology for Selected Colorado Stations
	Charles David Whiteman	Ph.D.	1980	Breakup of Temperature Inversions in Colorado Mountain Valleys
Prof. D.B. Rao	J. Michael Fritsch	M.S.	1969	Objective Analysis of a Two-Dimensional Data Field by the Cubic Spline Technique
Prof. James Rasmussen	Lee K. Balick	M.S.	1971	A Study of Orographic Clouds
	Gary E. Bertolin	M.S.	1970	A Climatology of the Pawnee National Grassland
	Dennis E. Bielicki	M.S.	1978	Estimation of Big Thompson Flood Rainfall Using Infrared Satellite Imagery
	Donald L. Hadley	M.S.	1970	Precipitation Patterns in a Cyclone
	John T. Parisi	M.S.	1970	
	John O. Rhea	M.S.	1972	Interpreting Orographic Snowfall Patterns
	John E. Rubenacker	M.S.	1969	
	Elden C. Taylor	M.S.	1971	
Prof. Elmar Reiter	Robert F. Abbey	M.S.	1973	
	Robert F. Adler	Ph.D.	1974	A Comparison of the Structure and Flow Characteristics of the Upper Troposphere and Stratosphere of the Northern and Southern Hemispheres
	Bradford R. Bean	Ph.D.	1966	Radio Studies of Atmospheric Water Vapor

Major Professor	Student	Degree	Year	Thesis Title
Prof. Elmar Reiter	Jan Behunek	M.S.	1980	The Role of Moisture Flux in Atmospheric Feedback Mechanisms Over the Tropical Oceans
	Donald W. Beran	M.S.	1966	Large Amplitude Lee Waves and Chinook Winds
	Paul E. Ciesielski	M.S.	1980	Variability Within the Ocean-Atmospheric Mechanisms Over the North Pacific
	Thomas J. Corona	M.S.	1978	The Interannual Variability of Northern Hemispheric Precipitation
	Austin G. Cotton	M.S.	1970	
	William E. Davis	M.S.	1965	
	Richard A. Dirks	Ph.D.	1970	A Theoretical Investigation of Convective Patterns in the Lee of the Colorado Rockies
	Nenad Djordjevic	M.S.	1967	Denver Air Pollution Study with Air Trajectories
	Roger T. Edson	M.S.	1980	Parameterization of Net Radiation at the Surface Using Data from the Wangara Experiment
	Harry P. Foltz	Ph.D.	1967	Prediction of Clear Air Turbulence
	Benjamin C. Hablutzel	M.S.	1970	
	Chi Nan Hsiao	M.S.	1979	Interannual Variation of Atmospheric Meridional Eddy Transports
	Paul C. Katen	Ph.D.	1977	Modeling Atmospheric Dispersion of Lead Particulates from a Highway
	Thomas J. Kleespies	M.S.	1977	Observations of Stratospheric Thermal Structure from Satellites
	Peter F. Lester	Ph.D.	1970	Some Physical and Statistical Aspects of Clear Air Turbulence
	James E. Lovill	Ph.D.	1972	The Global Distribution of Total Ozone as Determined by the NIMBUS III Satellite Interferometer Spectrometer
	Bruce C. MacDonald	M.S.	1974	Stratospheric Flow and Solar Variability

Major Professor	Student	Degree	Year	Thesis Title
Prof. Elmar Reiter	Jerry Mahlman	M.S.	1964	Relation of Stratospheric-Tropospheric Mass Exchange Mechanisms to Surface Radio Activity Peaks
		Ph.D.	1967	Atmospheric General Circulation and Transport of Radioactive Debris
	James P. McGuirk	Ph.D.	1978	Fluctuations in the Atmosphere's Energy Cycle
	Bernard Mitambo	M.S.	1980	Mass Exchanges Between Stratosphere and Troposphere Under the Influence of a Strong Jet Stream
	Frank D. Reeder	M.S.	1968	
	James D. Sartor	Ph.D.	1970	General Thunderstorm Electrifications
	George J. Schewe	M.S.	1975	A Climatology of Inversions
	Anne D. Seigel	M.S.	1977	Oceanic Latent and Sensible Heat Flux Variability and Air-Interaction
	Srinivasan Srivatsangam	Ph.D.	1975	Atmospheric Eddy Transports and Their Efficiencies
	Borislava V. Stankov	M.S.	1970	Some Characteristics of Turbulence in the Lower 200 Feet of the Atmosphere
	Ann M. Starr	M.S.	1976	Interannual Variations and Regional Effects of Hemispheric Parameters
	Keith O. Timbre	M.S.	1978	
	Dennis S. Walts	M.S.	1968	Transport Processes During Stratospheric Warming and Cooling Episodes
	Willis L. Webb	Ph.D.	1972	Atmospheric Neutra-Electrical Interaction
	Gene L. Wooldridge	Ph.D.	1970	Vertical Momentum Transport Over Mountainous Terrain

Major Professor	Student	Degree	Year	Thesis Title
Prof. Herbert Riehl	James R. Connell	M.S.	1966	A Transient State of a Wave in the Easterlies
	Joseph B. Dankwa	M.S.	1968	Some Aspects of Precipitation Occurring in Summer Disturbances Over Southeast Asia
	Russell L. Elsberry	Ph.D.	1968	A High-Rotation General Circulation Model Experiment with Cyclic Time Changes
	Everett D. Figgins	M.S.	1966	Weather Pattern Recognition from TIROS Pictures Over Southeast Asia
	Arnold I. Finklin	M.S.	1967	Precipitation and Runoff Characteristics of the Sacramento Basin
	William J. Kamm	M.S.	1971	
	William R. Kininmonth	M.S.	1970	Thermal Modification of the Troposphere due to Convective Interaction
	Stephen E. G. Ladochy	M.S.	1969	
	Pedro P. Pacheco	M.S.	1972	The Subcloud Layer of Venezuelan Storms
	Allan F. Rainbird	M.S.	1967	Some Hydrometeorological Aspects of Flood Flows in the Lower Mekong River, Southeast Asia
	James L. Rasmussen	M.S.	1963	Some Aspects of the Monthly Atmospheric Circulation Affecting Monthly Precipitation over the Colorado River Basin
		Ph.D.	1968	Atmospheric Water Balance of the Upper Colorado River Basin
	Francis E. Robitalle	M.S.	1970	
	Charles P. Stephens	M.S.	1966	
	A. Sundararajan	M.S.	1973	

Major Professor	Student	Degree	Year	Thesis Title
Prof. Wayne Schubert	Joseph J. Butchko	M.S.	1978	A Diagnostic Case Study of the 9-11 August Period During GATE
	Scott R. Fulton	M.S.	1980	Geostrophic Adjustment in a Stratified Atmosphere
	James J. Hack	M.S.	1977	Numerical Experiments with an Axisymmetric Tropical Cyclone Model
		Ph.D.	1980	The Role of Convective-Scale Processes in Tropical Cyclone Development
	Sudama Raghunandan	M.S.	1978	Gradient Adjustment in an Axisymmetric Vortex
	Pedro L. Silva Dias	M.S.	1977	Experiments with the Arakawa-Schubert Cumulus Parameterization Theory
		Ph.D.	1879	Dynamics of Equatorial Mass-Flow Adjustment
	Ellen J. Steiner	M.S.	1977	Stratocumulus Convection Off the South American Coast
	Joseph S. Wakefield	M.S.	1978	Numerical Simulation of Eastern North Pacific Turbulence Model
Prof. Peter Sinclair	Wayne E. Clark	M.S.	1973	Analysis of Point Seeding Pyrotechnics
	Robert E. Fischer	M.S.	1969	Remote Sensing of Hail and Hail Growth in Convective Clouds
	John W. Glendening	M.S.	1977	Aeolian Transport and Vegetative Capture of Particulates
	Verne H. Leverson	M.S.	1978	Waterspout Structure and Dynamics
	Alf C. Modahl	M.S.	1969	The Influence of Vertical Wind Shear on Hailstorm Development and Structure
	Allan J. Schanot	M.S.	1977	The Structure and Mixing Processes of Mountain Cumulus Clouds
	James G. Stobie	M.S.	1976	Gravity Shear Waves Atop the Cirrus Layer of Intense Convective Storms

Major Professor	Student	Degree	Year	Thesis Title
Prof. Peter Sinclair	Peter J. Wetzel	M.S.	1978	Moisture Sources and Flow Patterns During the Northeast Colorado Hail Storm
Prof. Patrick Squires	August H. Auer	M.S.	1965	The Vertical Distirbution of Aitken Nuclei in the Vicinity of Fort Collins, Colorado
Prof. Duane Stevens	Alison F. Bridger	Ph.D.	1980	Wave-Mean Flow Interactions and Solar-Weather Effects
	Maria F. Silva Dias	Ph.D	1979	Linear Spectral Model of Tropical Mesoscale Systems
Prof. T. Vonder Haar	Robert M. Arn	M.S.	1975	Anvil Area and Brightness Characteristics as Seen from Geosynchronous Satellites
	Norman E. Buss	M.S.	1981	
	George G. Campbell	Ph.D.	1981	Energy Transport Within the Earth's Atmosphere Ocean Systems from a Climate Point of View
	Anthony W. Colley	M.S.	1979	
	Ceri B. Dean	M.S.	1979	Observation of Progressive Convective Interaction from the Rocky Mountain Slopes to the Plains
	Patrick H. Downey	M.S.	1972	Distribution and Parameterization of Absorption of Solar Radiation in the Atmosphere
	Phil Durkee	M.S.	1980	Summer Precipitation Frequency of the North Central U.S. from Satellite Microwave Observations
	Larry Chorowski	M.S.	1981	
	James S. Ellis	M.S.	1972	Interannual Variation in the Earth's Radiative Budget and the General Circulation
		Ph.D.	1978	Cloudiness, The Planetary Radiation Budget, and Climate
	Merlyn C. Forsyth	M.S.	1979	
	Donald W. Hillger	M.S.	1976	Mesoscale Temperature and Moisture Fields from BTPR Sounding Radiances

Major Professor	Student	Degree	Year	Thesis Title
Prof. T. Vonder Haar	Robert E. Introne, Jr.	M.S.	1975	
	Stanley Q. Kidder	M.S.	1976	Tropical Oceanic Precipitation Frequency from Nimbus-5 Microwave Data
		Ph.D.	1979	Determination of Tropical Cyclone Surface Pressure and Winds from Satellite Microwave Data
	Marjorie Klitch	M.S.	1982	Compositing GOES Data to Detect Regions of Enhanced Convective Development Around Eastern Montana
	David C. Loranger	M.S.	1974	Convective Cloud Ring Structures in the Tropical Atlantic
	Roland A. Madden	Ph.D.	1978	Traveling Planetary Waves and Their Effect on the General Circulation
	Robert Maddox	Ph.D.	1981	The Structure and Life Cycle of Midlatitude Mesoscale Convective Complexes
	Harvey J. Miller	M.S.	1972	Real-Time Direct Read-Out Satellite Support to Field Projects and/or Small Weather Groups
	Kenneth R. Morris	M.S.	1979	Satellite Studies of Sierra Nevada Winter Storms in Support of Weather Modification
	Andrew J. Negri	M.S.	1977	Satellite Observations of the Onset and Growth of Severe Local Storms
	Stephen P. Pryor	M.S.	1978	Measurement of Thunderstorm Cloud-Top Parameters Using High-Frequency Satellite Imagery
	David W. Reynolds	M.S.	1973	Absorption of Solar Radiation in the Tropics and its Effects on Mesoscale Weather Activity
	Peter G. Sagert	M.S.	1974	The Tall Stack
	Gerald J. Sikula (deceased)	M.S.	1971	ATS III Data as a Forecasting Aid
	Eric A. Smith	M.S.	1980	Orbital Mechanics and Analytical Modeling of Meteorological Satellite Orbits
	Young P. Yee	M.S.	1978	Optimum Interpolation of Radiosonde and Satellite-Derived Temperature Fields

CURRENT GRADUATE STUDENTS

Name	Degree	Advisor
Anderson, John R.	Ph.D.	New Student
Arritt, Raymond W.	Ph.D.	Pielke
Askue, Cecilia A.	M.S.	New Student
Bader, David C.	Ph.D.	McKee
Banta, Robert M.	Ph.D.	Cotton
Blanchard, David S.	M.S.	New Student
Blumenstein, Rochelle R.	M.S.	Grant
Bossert, James E.	M.S.	Reiter
Borys, Randolph D.	Ph.D.	Grant
Cairns, Mary M.	M.S.	Pielke
Chan, Johnny C.	Ph.D.	Gray
Chen, Chaing H.	Ph.D.	Cotton
Chen, Phillip S.	M.S.	New Student
Chen, Wun-Iuang	M.S.	New Student
*Conley, John R.	M.S.	McKee
Crum, Francis X.	M.S.	Stevens
Culverwell, Arlene L.	M.S.	Cotton
Cunning, John B.	M.S.	Cotton
DeMaria, Mark	Ph.D.	Schubert
DeMott, Paul J.	M.S.	Grant
Dobo, Steven M.	M.S.	Cotton
Duprey, Nancy J.	M.S.	Cotton
Durkee, Philip A.	Ph.D.	Vonder Haar
Dye, Anita F.	M.S.	McKee
Franchi, Lynnette M.	M.S.	New Student
Freeman, Larry E.	Ph.D.	Cox
Fulton, Scott R.	Ph.D.	Schubert
Gould-Stewart, Sharon	M.S.	New Student
Greeson, Joseph S.	M.S.	Grant
Griffith, Cecelia M.	Ph.D.	Vonder Haar
Hanna, Adel F.	Ph.D.	Reiter
Hanson, Keeley R.	M.S.	McKee

Hepler, Karen E.	M.S.	Stevens
Hillger, Donald W.	Ph.D.	Vonder Haar
Holland, Greg J.	Ph.D.	Gray
Jones, Gerald W.	M.S.	McKee
Jorgensen, David P.	Ph.D.	Cotton
Kawa, Stephan R.	M.S.	Pearson
Kelly, Francis P.	M.S.	Vonder Haar
Klazura, Gerard E.	Ph.D.	Grant
Kopp, Frederick J.	Ph.D.	Cotton
Kuo, Hung-Chi	Ph.D.	Grant
Lee, Cheng-Shang	Ph.D.	Gray
Levy, Gad	M.S.	Cotton
Lin, Dong-Yau	M.S.	Sinclair
Lin, Ming-Sen	Ph.D.	Cotton
Lipton, Alan E.	M.S.	Vonder Haar
Magnusdottir, Gudrno	M.S.	Cox
Matsumoto, Clifford R.	Ph.D.	Gray
Matthews, David A.	Ph.D.	Cotton
McQueen, Jeffery T.	M.S.	Pielke
Medina, John G.	Ph.D.	Grant
*Merrill, Robert T.	M.S.	Gray
Morrison, Brian J.	M.S.	New Student
Motallebi, Nehzat	M.S.	Cotton
Nicholls, Melville E.	M.S.	Johnson
O'Connor, Lauraleen	M.S.	New Student
Parker, Hugh A.	M.S.	Sinclair
Purdom, James F.	Ph.D.	Sinclair
Randel, David L.	M.S.	Vonder Haar
Raschke, Robert A.	M.S.	Cox
*Reinke, Donald L.	M.S.	Vonder Haar
Reynolds, David W.	Ph.D.	New Student
Rilling, Robert A.	Ph.D.	Grant
Rodgers, Edward A.	Ph.D.	New Student
Rodrigues, Jose	Ph.D.	Reiter
Rodrigues, Rute	M.S.	McKee
Rogash, Joseph A.	M.S.	Vonder Haar

Sarma, Ananthakrishna	Ph.D.	Cotton
Seagraves, Mary A.	Ph.D.	McKee
Shih, Chi-Fan	Ph.D.	New Student
Smith, Eric A.	Ph.D.	Vonder Haar
Smith, Jeffery K.	M.S.	McKee
Smith, Tracy L.	M.S.	Cox
Song, Jenn-Luen	Ph.D.	Pielke
Starr, David O.	Ph.D.	Cox
Stoker, Timothy D.	M.S.	Stevens
Tan, Kapin	M.S.	Grant
Teixeira, Luiz	Ph.D.	Reiter
Toth, James J.	M.S.	Johnson
Tremback, Craig, J.	Ph.D.	Cotton
Tripoli, Gregory J.	Ph.D.	Cotton
*Tucker, Donna F.	M.S.	Reiter
Tunick, Arnold D.	M.S.	New Student
Uttal, Taniel	M.S.	Grant
Weaver, Clark J.	Ph.D.	New Student
Weber, Bonnie F.	M.S.	Pearson
Weiss, Mitchell	M.S.	Vonder Haar
Wellman, Dennis L.	M.S.	Grant
Williams, Gary M.	M.S.	Grant
Wolfe, Daniel E.	M.S.	Johnson
Woodruff, Brian L.	M.S.	New Student
Young, George S.	Ph.D.	New Student

*These students have completed all academic requirements and passed their final oral examinations for their degrees and plan to graduate in Summer of 1982.

ADDITIONAL DEPARTMENT RESEARCH STAFF AND DATE OF INITIAL APPOINTMENT

Steven Ackerman	October 16, 1979	*Research Associate*
David Neil Allen	July 1, 1980	*Research Associate*
David C. Bader	September 1, 1980	*Research Associate*
Jan L. Behunek	November 1, 1980	*Research Associate*
Paul E. Ciesielski	July 15, 1980	*Research Associate*
Thomas M. Cipriani	January 1, 1982	*Research Associate*
Donald R. Cobb	January 1, 1978	*Research Associate*
John Davis	August 1, 1981	*Research Associate*
Nolan J. Doesken	December 1, 1977	*Research Associate*
William Finnegan	July 1, 1978	*Research Associate*
Jeff Gailiun	February 16, 1979	*Coordinator*
Ray Garcia	May 5, 1981	*Coordinator*
Marion Haurwitz	October 16, 1978	*Research Associate*
Teizi Henmi	April 1, 1974	*Research Assistant Prof.*
Ed Hindman	January 1, 1979	*Research Associate*
Bob Kessler	February 1, 1982	*Research Associate*
John Kleist	November 11, 1979	*Research Coordinator*
Melanie Kruidenier	November 1, 1980	*Resaerch Associate*
Pat Laybe	December 30, 1980	*Research Coordinator*
Raymond McAnelly	August 15, 1980	*Research Associate*
Walter L. Naylor	February 1, 1979	*Department Manager*
Christopher Johnson-Pasqua	July 1, 1980	*Research Coordinator*
Richard M. Peek	January 15, 1981	*Research Coordinator*
Brian L. Plomondon	May 19, 1980	*Research Associate*
Kristine Randolph	October 17, 1980	*Research Associate*
Robert M. Rauber	September 1, 1981	*Research Associate*
Mordecay Segal	February 1, 1982	*Research Associate*
John D. Sheaffer	December 16, 1978	*Research Associate*
Eric A. Smith	March 1, 1975	*Research Assistant Prof.*
Isabel Starner	December 16, 1981	*Research Coordinator*
Gregory J. Tripoli	April 1, 1976	*Research Associate*
Patricia Walsh	November 16, 1981	*Research Associate*
Mark J. Whitcomb	April 1, 1979	*Research Coordinator*

CURRENT SUPPORT STAFF

Andrea K. Adams	December 15, 1980
Duayne Barnhart	April 1, 1979
Earlene V. Bradley	November 10, 1961
Barbara E. Brumit	August 20, 1970
Grant W. Burton	September 1, 1980
Janis L. Davis	November 16, 1973
Verna R. Frick	September 7, 1981
John J. Graffy	July 14, 1980
Bonnie R. Grantham	July 18, 1977
Judy C. Gueswel	August 24, 1978
Randy Horn	April 29, 1974
Charlotte Johnson	July 1, 1981
Mary Kremer	May 19, 1980
Camille E. Krug	February 1, 1981
Lucy McCall	February 26, 1971
Sally McLeland	July 1, 1970
Deborah Mraz	September 1, 1981
Shazi Naqvi	December 4, 1980
Odie Panella	August 23, 1978
Sara Rumley	March 15, 1982
Machel Sandfort	September 22, 1980
Cindy Schrandt	February 9, 1981
Elmer Sterkel	April 1, 1967
Cleon Swain	July 1, 1970
Brenda Thompson	November 11, 1981
Melissa Tucker	August 26, 1981
Juanita Veen	August 1, 1971
Charlie Wilkins	May 11, 1970
Delbert Wilkins	May 19, 1980

Hill on which Atmospheric Science Building is as seen in March 1966.

Building on 28 July 1966

Building on 13 September 1966

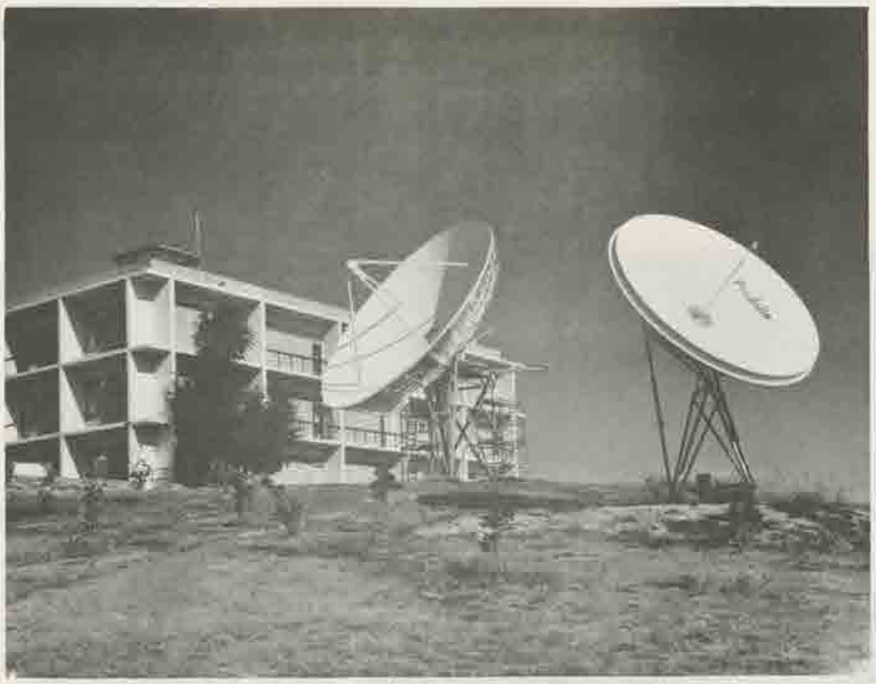
Finished building on 29 December 1966
Note authentic "cow college" atmosphere.

High Altitude Observatory (HAO) Building on CU campus in Boulder from which original plans for Atmospheric Science Building were taken.

Close up view of HAO Building

Elmar Reiter presiding at Atmospheric Science Building dedication in June 1967. Seated guests are Fred White, then head of WSF Atmospheric Science Division; Senator Peter Dominick; Arthur Sheeley, State Board of Agriculture Chairman and Bill Morgan, CSU President.

Assembled visitors for building dedication in June 1967



Tom Vonder Haar's receiving dishes for direct reception of GOES east and west satellite pictures.

Ground equipment for satellite reception and display.

Fort Collins Country Club banquet for building dedication in June 1967. L. to R. Elmar Reiter, Fred White of NSF, CSU President Bill Morgan, Gabriella Reiter, and Ken Spengler, executive secretary of the AMS.

CURRENT FACULTY MEMBERS

Elmar Reiter
(1961)

OLDER DOGS

Lew Grant
(1959)

Bill Gray
(1961)

Pete Sinclair
(1966)

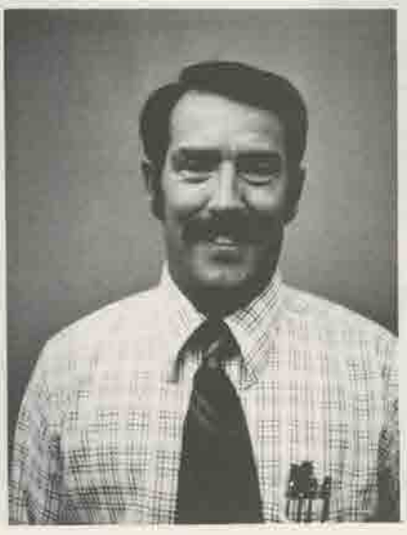
Bernard Haurwitz
(faculty affiliate 1962-1973)
faculty member since 1973
(member National Academy
of Science)

THE SECOND WAVE

Steve Cox
(1969)

Tom Vonder Haar
(1970)
Dept. Head
1974 - present

Wayne Schubert
(1973)



Tom McKee
(1974)
Colo. State Climatologist

Bill Cotton
(1974)

THE NEW KIDS ON THE BLOCK

Duane Stevens
(1978)

Richard Johnson
(1980)

Richard Pearson, Jr.
(1981)

Roger Pielke
(1982)

PAST

FACULTY

MEMBERS

Herbert Riehl

DEPARTMENT FOUNDER

Bill Marlatt
(1969-1970)

Mike Corrin
(1967-1980)
(deceased)

Helene Poland
(1973-1976)

Allan Betts
(1970-1978)

U.S. Senator from Colorado, Peter Dominick (left) and James Rasmussen (right) (one of our first graduate students) at building dedication in 1967.

A beardless Ferdinand Baer (faculty member 1961-1971) examining dishpan pictures in 1965.

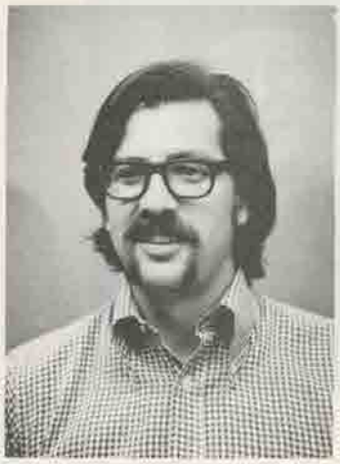
Richard Schleusener, organizer and director of the first hail study experiments in northwest Colorado in the early 1960's, at his desk in 1964. Dick is now president of South Dakota School of Mines.

LONG-TERM RESEARCH ASSOCIATES

Bill Kamm
1964 - 1972

Glen Briar
1972 - present

Tezi Henmi
1969 - present



Eric Smith
1974 - present

DEPARTMENT MANAGERS

William R. Green
(1961-1972)
(deceased)

John Vetter
(1964-1975)

Capt. W. R. (Slim) Somervell
(1970-1981)
(U.S. Navy retiree)

Dave Cismoski
(1975-1978)

Walt Naylor
(1979-present)

VALUABLE LONG-TERM DEPARTMENTAL STAFF MEMBERS AND RESEARCH STAFF

Earlene Bradley
1962 - present

Duayne Barnhart
1964 - present

Sally McLeland
1970 - present

LONG-TERM RESEARCH PROJECT MEMBERS

Lucy McCall
1970 - present

Barbara Brumit
1970 - present

Juanita Veen
1971 - present

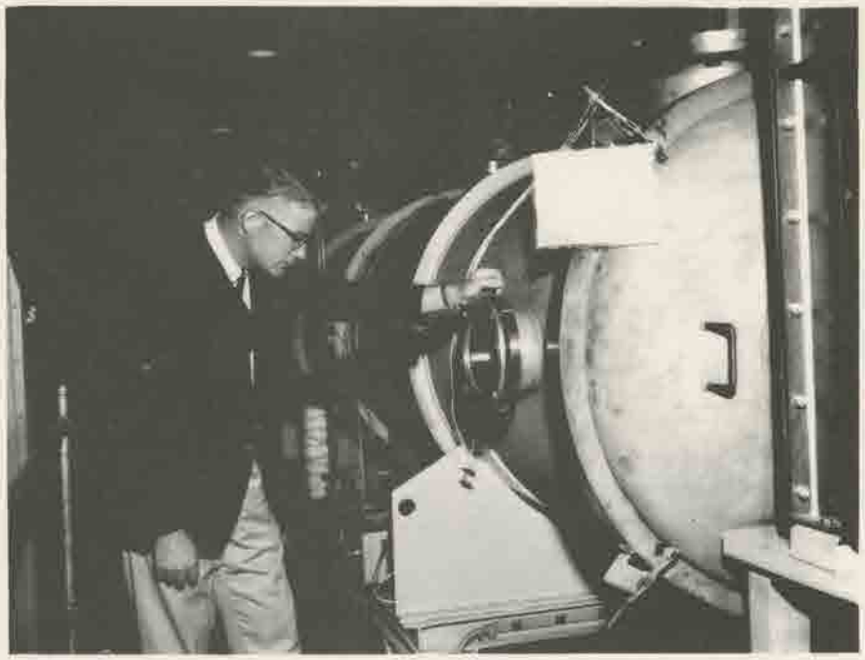
Elmer Sterkel
1967 - present

Charles Wilkins
1970 - present

Edwin Buzzell
1968 - 1982

Jan Davis
1973 - present

IMPORTANT ENGINEERING COLLEGE ASSOCIATES



Dean Lionel Baldwin examining an ERC high vacuum test facility in 1967

Associate Dean Daryl Simons inspecting an ERC hydraulics experiment in 1967.