UNIVERSITY OF MINNESOTA
TWIN CITIES

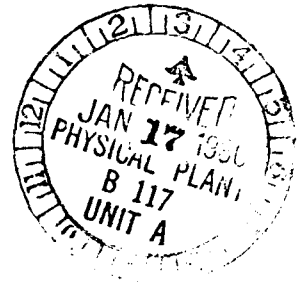
University Hospitals and Clinics
420 Delaware Street S.E.
Minneapolis, Minnesota 55455

JAN 25 Rec'd
UNIV. OF MINN.
HEALTH SCIENCE
PLANNING OFFICE

Paul, For your information.
Dick H.

January 16, 1980

To: Nancy Omundson
Dick Hendricks
Roberta Collins
Lt. John C. Foley
Phyllis Johnson
Bob Nygren
Kathy Countryman
Dr. Dan Hankins



From: Greg Hart

Subject: Unit BC-Extreme Wind Condition Plan

It has become apparent, particularly after last Friday's incident, that we will occassionally be faced with the extreme "wind tunnel" conditions around Unit BC as we have on two occasions in the past year. I believe we have all responded exceptionally well during those two critical incidents; at the same time, we should be better prepared to handle them in the future. There is a critical one to two hour period, as we are organizing our response to the extreme wind, during which people entering and exiting are in real danger. We need to minimize that time period as much as possible. I am thus proposing that we jointly develop a plan which will allow us to quickly respond to the wind conditions, in order to minimize the period during which people will be at risk. Key elements of that plan would seem to include:

1. A description of how the response plan is initiated and who can make the decision to initiate.

2. A description of the public address announcements that will be made following initiation of the plan.

3. A communications plan for the clinics and other BC occupants.

4. A plan for immediate rerouting of the shuttle bus.

5. A mechanism for control of pedestrian traffic through the "tunnel."

6. A means for gathering manpower to act as escorts to and from BC, Mayo, and Masonic.

7. Assignment of personnel as "door guards" at the main entrance of BC.

8. A description of the roles of the following departments when the wind

tunnel response plan is initiated:

a) Outpatient Department
b) Emergency Department
c) Protection Services
d) Communications Center/BC Information Desk
e) Volunteer Services
f) University Police
g) Physical Plant
h) Patient Relations

We will be setting up a meeting for the near future in order to facilitate development of such a plan. I would appreciate your giving some thought to each of the above points in preparation for that meeting. If there are other areas which should be included in the plan, you should, of course, feel free to bring them up.

Please let me know if you have any questions or suggestions, and thank you in advance for your cooperation.

GH/GS

50 Moulton Street
Cambridge, Mass. 02138
Telephone (617) 491-1850
Telex No. 92-1470

Bolt Beranek and Newman Inc.

28 March 1980

The Architects Collaborative Inc.
46 Brattle Street
Cambridge, MA 02138

Attn: Mr. John M. Patterson, Senior Associate

Subject: Proposal to Investigate Solutions to Wind Problems at Minnesota Health Sciences Center, Minneapolis, MN

Re: BBN Proposal P80-21-031

Gentlemen:

Bolt Beranek and Newman Inc. (BBN) is pleased to submit this proposal to assist TAC in identifying and mitigating wind problems which have arisen at the Minnesota Health Services Center. Our proposal contemplates an experimental study in BBN's Atmospheric Boundary Layer Wind Tunnel, using a suitable model to be supplied by TAC. Such a study would be interactive in nature, with your project architect(s) being present during the tests to assess our findings and consult with us on feasible design alternatives which can subsequently be quickly evaluated by in-situ modifications to the model, and a repeat of the tests. Below, we outline the course of the study. Attached to this letter are a general description of BBN's activities and capabilities, a description of our wind tunnel and wind activities, and a copy of our Standard Terms and Conditions which would apply to the work conducted on this project.

SCOPE OF WORK:

The assessment of the wind problems at the Health Sciences Center requires two major areas of study:

(1) Identification of local wind phenomena and quantifying the impacts thereof by use of a wind tunnel model.

(2) Assessment of the probability of occurrence of the wind related phenomena by examination and analysis of long-term weather records for the site.

The second task is actually largely done prior to the wind tunnel tests, in that the data is required by a computer algorithm which is used to facilitate interpretation of wind tunnel results.

Specific problem areas which will be investigated in the project are:

- causes of high wind speeds in pedestrian areas, including the loading/unloading area in the tunnel.

- causes of the cold air ingestion in the reception area.

- architectural approaches to solutions of the above problems.

- quantification of the residual impact (i.e., percent of time and seasonal probability of occurance of adverse conditions).

The approach to these problems will be to:

(1) Obtain and analyze wind records from the Minneapolis area to determine predominant wind directions and speeds by season (i.e., "azimuthal probability of exceedence" of various wind speeds).

(2) Instrument a TAC-supplied model to measure pressure and velocity at those areas identified as being troublesome, as well as areas which we feel can provide insight into the causes of the problems.

(3) Conduct a flow visualization study in the wind tunnel to enable a qualitative assessment of flow behavior around the buildings in the complex.

(4) Measure velocity and pressures at key points on the model as a continuous function of wind azimuth.

(5) Interpret raw data from wind tunnel to identify those key wind directions for which architectural solutions are needed.

(6) Propose potentially effective solutions to the TAC personnel, and test those solutions which are architecturally feasible.

(7) Prepare an informal report summarizing findings and recommendations

SCHEDULE

The work described in this proposal can be performed in 4 weeks after receipt of model, pending wind tunnel availability at the time.

COST

We propose to conduct this study under our normal Time and Materials terms and conditions, which are attached. We estimate the cost of tasks 1-5 to be about $7,000, and the investigation of 2-3 solutions under task 6 to be about $2-3K. Additional testing and analysis of wind tunnel data can be roughly estimated at $1,000/day of testing. Therefore, we expect the total cost of the work to be in the range of $10-12K.

PERSONNEL

This project will be conducted by BBN's Aero Sciences Department. Mr. Leonard Fortier will be assigned as the principal investigator and project manager. As such, he will be responsible for timely and cost-effective performance of the work and all interfaces with TAC. In his absence, Mr. Richard Hayden will be cognizant of the project status.

At this time, the demands on the tunnel are heavy. We will do our utmost to schedule this project into the tunnel at a time which will enable you to meet your own schedular objectives.

If there are questions regarding this proposal, please contact the undersigned or Mr. Fortier at the address on our letterhead.

Sincerely,
BOLT BERANEK AND NEWMAN INC.

Richard E. Hayden
Manager, Aero Sciences Department

REH/cdp

Encl:

cc: L. Fortier
S. Zigun

TAC

THE ARCHITECTS COLLABORATIVE INC.

4 April 1980

Mr. Paul Maupin
Health Sciences Planning Office
4104 Powell Hall
University of Minnesota
Minneapolis, Minnesota 55455

RE: Proposed Wind Condition Analysis

Dear Paul,

As requested in our meeting the week of March 10, 1980, we hereby submit our proposal for undertaking a wind study of the Health Sciences Campus. We have invited Bolt, Beranek, and Newman, Inc. (BBN) to join us in this study based on their expertise and technological ability to support such a study. If there are other engineers that the University would like us to consider for the study, we would be open to considering them as alternatives.

In their proposal to TAC which is attached, BBN has outlined the basic steps that will be followed in the study. In addition to administrating BBN's effort, TAC/HSAE will produce a model of the H.S. Campus appropriate for testing purposes and participate in the testing process, exploring design solutions to reduce the impact of Unit J on wind conditions, but we feel our involvement in this aspect of the study should be quite limited unless otherwise directed by the University with the concurrence of the Hospital's Architects.

We would propose to undertake the study on an hourly basis and would estimate its costs as follows:

Production of Model	$ 5,000.00
BBN'S Testing	10,000.00 - 12,000.00
TAC/HSAE Administration and Design Solution Exploration	5,000.00
Estimate of Total Cost	$20,000.00 - 22,000.00

If we can provide you with further information please let us know.

Very truly yours,

John M. Patterson
Senior Associate

Enclosures

cc: HSAE, ENCL

46 BRATTLE STREET, CAMBRIDGE, MASSACHUSETTS 02138, U.S.A.
TELEPHONE: (617) 868-4200 TELEX: 921494 TACCAM CABLE: TACCAM U.S.A.

B/C and Transit
analysis
yes

UNIVERSITY OF MINNESOTA
TWIN CITIES

Engineering and Construction Division
~~Physical Planning Office~~ Physical Plant Operations
26 Folwell Hall
9 Pleasant Street S.E.
Minneapolis, Minnesota 55455

April 17, 1980

Paul J. Maupin
Planning Coordinator, Health Sciences Planning Office
4103 Powell Hall

Dear Paul,

I hope you will accept my apologies for being tardy in responding to your memo of April 7, 1980.

I fully recognize the obvious need for "doing something" about the dangerous wind conditions being experienced between Units A and B under C.

Other observations concerning the proposed analysis:

1) The Bolt, Beranek and Newman facility is what is necessary and their proposal is well thought out and appears complete. However, the problem has arisen because of the TAC design, so their funded involvement does not seem appropriate.

2) If this analysis is to be undertaken, the impact on the problem of the proposed new hospital should be determined. This would seem to dictate, as a minimum, performing tests on simulations of possible hospital configurations. This information would have to be secured from Al Eilers, I assume.

3) I have heard an expressed concern (origin: unknown) over fume hood discharges from K/E and Mayo and their possible effect on the new hospital, principally during the construction phase of the hospital. While this office feels that there will be adequate dilution of exhausts to render them no health hazard, there may be some merit in exploring the potential of problems in this area as an added element of the proposed analysis.

Very truly yours,

E.B. Merz
Assistant Supervising Engineer

cc: W.E. Soderberg
Al Eilers

EBM/lrs

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
4103 Powell Hall, Box 75
500 Essex Street S.E.
Minneapolis, Minnesota 55455
(612) 373-8981

April 23, 1980

Mr. John Patterson
The Architects Collaborative, Inc.
46 Brattle Street
Cambridge, Mass. 02138

Subject: The Proposed Wind Condition Analysis

Dear John:

The University has reviewed your proposal for undertaking a wind study analysis of the Health Sciences Campus. All interested parties agree that while we are presently confronted with a very dangerous pedestrian wind condition, the investigation should be put on "hold" pending the completion of the new hospital configuration.

We appreciate your early response to our request. We are satisfied with the content and the completeness of the report.

Very truly yours,

Paul J. Maupin
Health Sciences Planning Coordinator

cc: Clint Hewitt
Robert Dickler
Duane Blanchard

PJM:jm

university of minnesota

memo

to Bob

from

Please have your impressions & comments to Paul by Monday 4-14-80

Jon

- ☐ For your information
- ☐ For your approval
- ☐ Approved
- ☐ For your attention
- ☐ Note and file
- ☐ Note and return
- ☐ Note and forward
- ☐ Please advise
- ☐ Please comment
- ☐ Please reply
- ☐ Please handle
- ☐ Send copy
- ☐ Please see me

Date 4/7 1980

S92046

TAC

THE ARCHITECTS COLLABORATIVE INC.

This letter says nothing about the 5th floor connecting link being a part of the project. APR 7 Need wasn't this one UNIV. OF MINN. of the problems to be covered by this proposal. Ltr 4/21/80

4 April 1980

Mr. Paul Maupin
Health Sciences Planning Office
4104 Powell Hall
University of Minnesota
Minneapolis, Minnesota 55455

RE: Proposed Wind Condition Analysis

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4/10/80

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Sincerely,
BOLT BERANEK AND NEWMAN INC.

Richard E Hayden

Richard E. Hayden
Manager, Aero Sciences Department

REH/cdp

Encl:

cc: L. Fortier
S. Zigun

BBN Facilities and Experience in Atmospheric Wind Effects Modelling

BBN is a consulting and research firm located in Cambridge, Massachusetts, employing nearly 1000 people. Our labs include three special purpose wind tunnels, including a fully equipped Atmospheric Boundary Layer Wind Tunnel, which is described in an attachment. We have a large inventory of portable lab and field instrumentation which can be used on wind problems, and an extensive in-house computer system for data processing and design calculations.

BBN's experience with wind problems on buildings and structures extends for nearly two decades, beginning in the mid-60's when we investigated wind-induced facade damage on the Chase-Manhatten Bank Building in New York, for Skidmore, Owings, and Merril. In 1970, we began wind tunnel work in our Cambridge labs, with a study of sway problems on Boston's New England Merchants Bank Building. This laboratory work was accompanied by field measurements, and ultimately the development of a high sensitivity accelerometer for measureing building motion and seismic vibration (now sold by BBN Instruments Co. as the Model 510 accelerometer). Soon thereafter, NASA selected BBN to model wind loads on the Space Shuttle while it is on the launch pad, and numerous other wint tunnel and field studies were performed for government and commercial clients.

In 1978, we purchased the assets of Weather Dynamics Inc., of Arlington, Mass., in order to have available a dedicated atmospheric boundary layer wind tunnel. That facility has been substantially expanded and upgraded and is now in regular use for wind loading, pedestrian wind, and pollution dispersion studies. It is one of the few facilities anywhere which is fully equipped for both loading and dispersion work.

BBN also manufactures its own research instrumentation, including hot wire anemometers pressure sensors, force balances, and sampling systems.

No other organization is as self-contained as BBN for conducting atmospheric wind effects studies.

DESCRIPTION OF TEST FACILITY AND PROCEDURES

Atmospheric Boundary Layer Wind Tunnel

The wind tunnel is 60 ft long and has an 8 × 6 ft cross section (see Fig. 1). Two eight ft turntables are located in the floor of the tunnel allowing placement of models at different locations in the tunnel. A typical installation is shown in Fig. 2. The facility was built specifically to simulate the interaction of the natural wind with structures and large-scale topographic features. The free-stream velocity in the tunnel is variable in the range of 1 to 35 ft/sec, providing Reynolds numbers up to 1.9×10^5 per ft. The atmospheric boundary layer profile is scaled in the tunnel using a series of spires at the entrance end of the tunnel (Fig. 3). Roughness elements upstream of the model in the tunnel maintain the velocity profile along the tunnel length (Fig. 4).

Flow Visualization

Conventional tuft and chemical smoke visualization techniques are used to aid in determining the qualitative aspects of flow phenomena of interest. Figure 5 is a photograph of the trajectory and growth of a buoyant plume from a large power plant. Facilities also include the application of a unique system employing neutrally buoyant, helium-filled soap bubbles. This system allows the observation of flow patterns in regions of highly turbulent flow, where conventional smoke visualization techniques prove to be ineffective due to dilution of smoke in the turbulent region. Figure 6 is a typical photograph of flow around a simple building complex using the bubble technique of flow visualization.

Concentration Measurements

For pollution dispersion studies, up to 100 points can be simultaneously sampled on a given run using multiple sampling nozzles, each

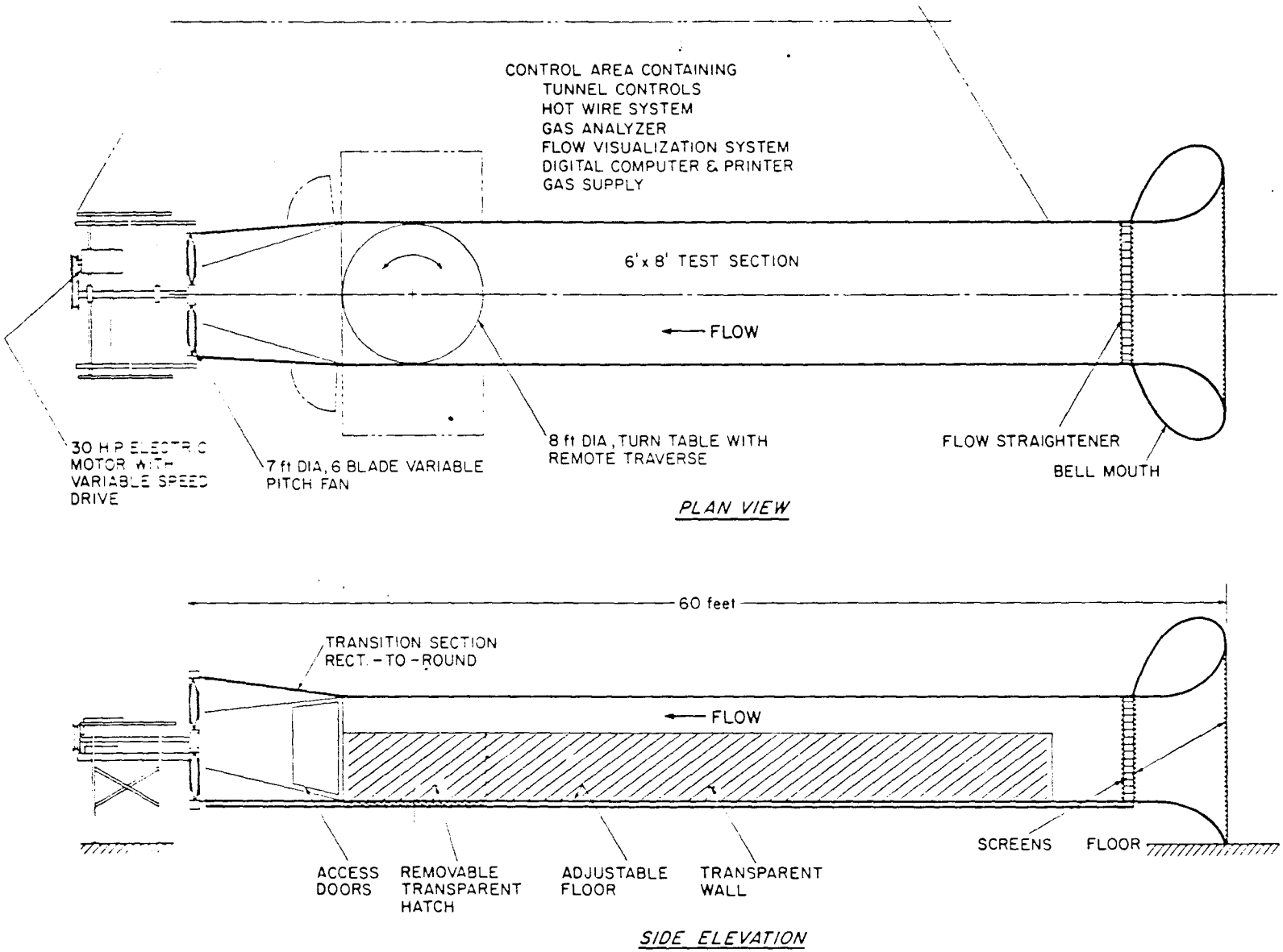


FIG. 1. BBN ATMOSPHERIC BOUNDARY LAYER TUNNEL.

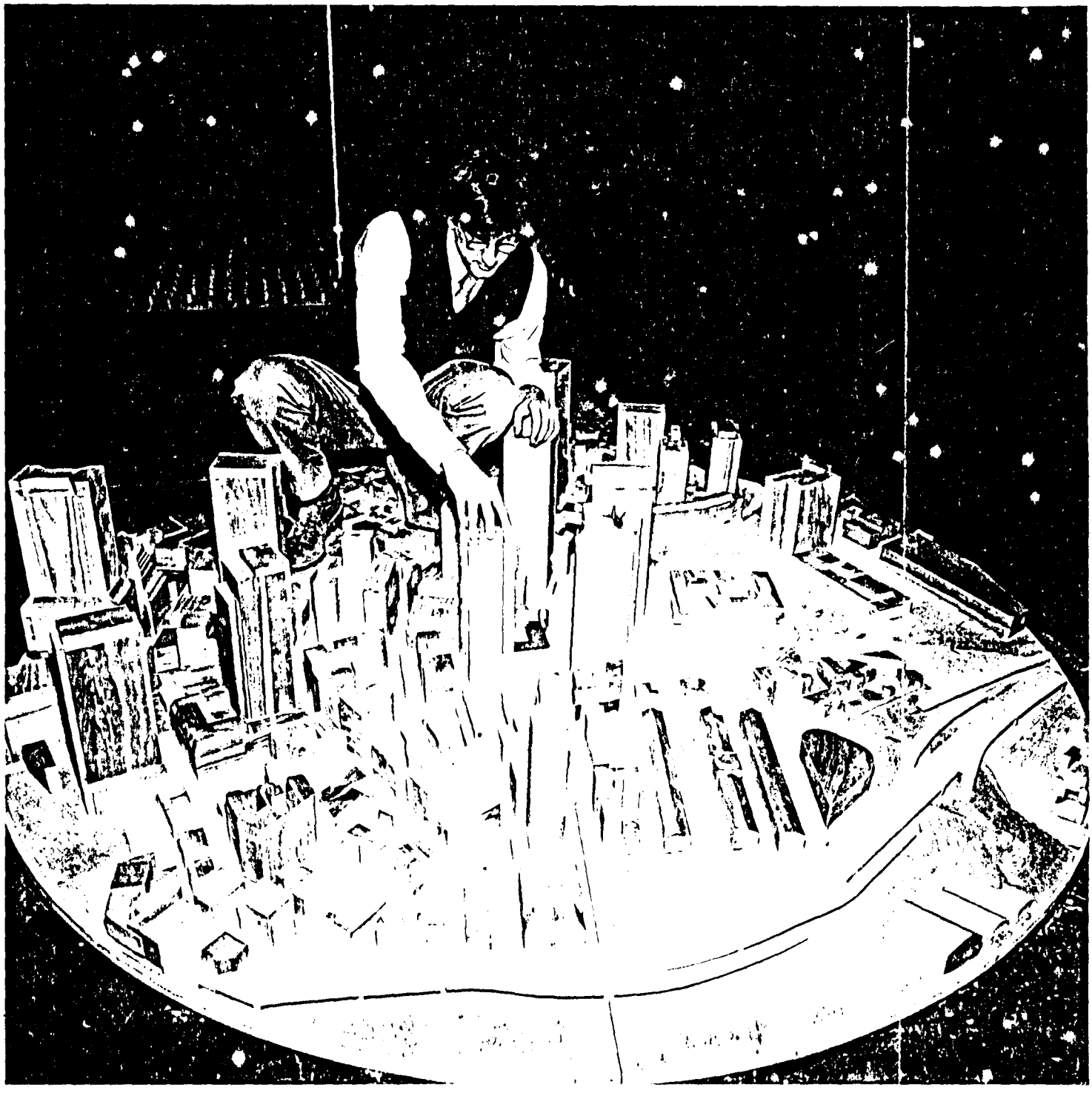


FIG. 2. MODEL OF GOVERNMENT CENTER, FINANCIAL DISTRICT, AND QUINCY MARKET AREA, BOSTON, MASSACHUSETTS, BEING ASSEMBLED IN BBN ATMOSPHERIC BOUNDARY LAYER WIND TUNNEL.

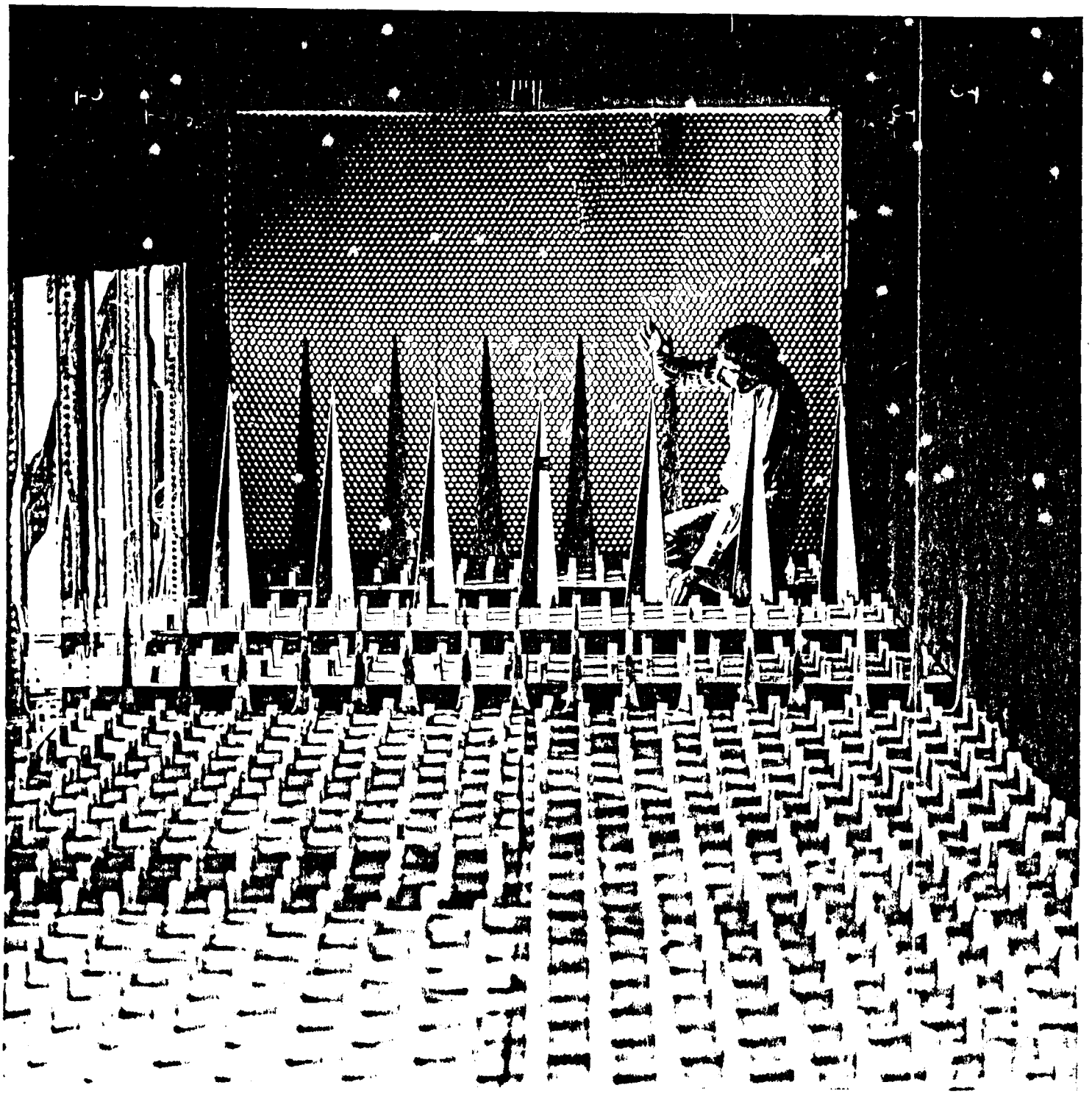


FIG. 3. VIEW OF INLET SECTION OF TUNNEL SHOWING SPIRES AND ROUGHNESS ELEMENTS.

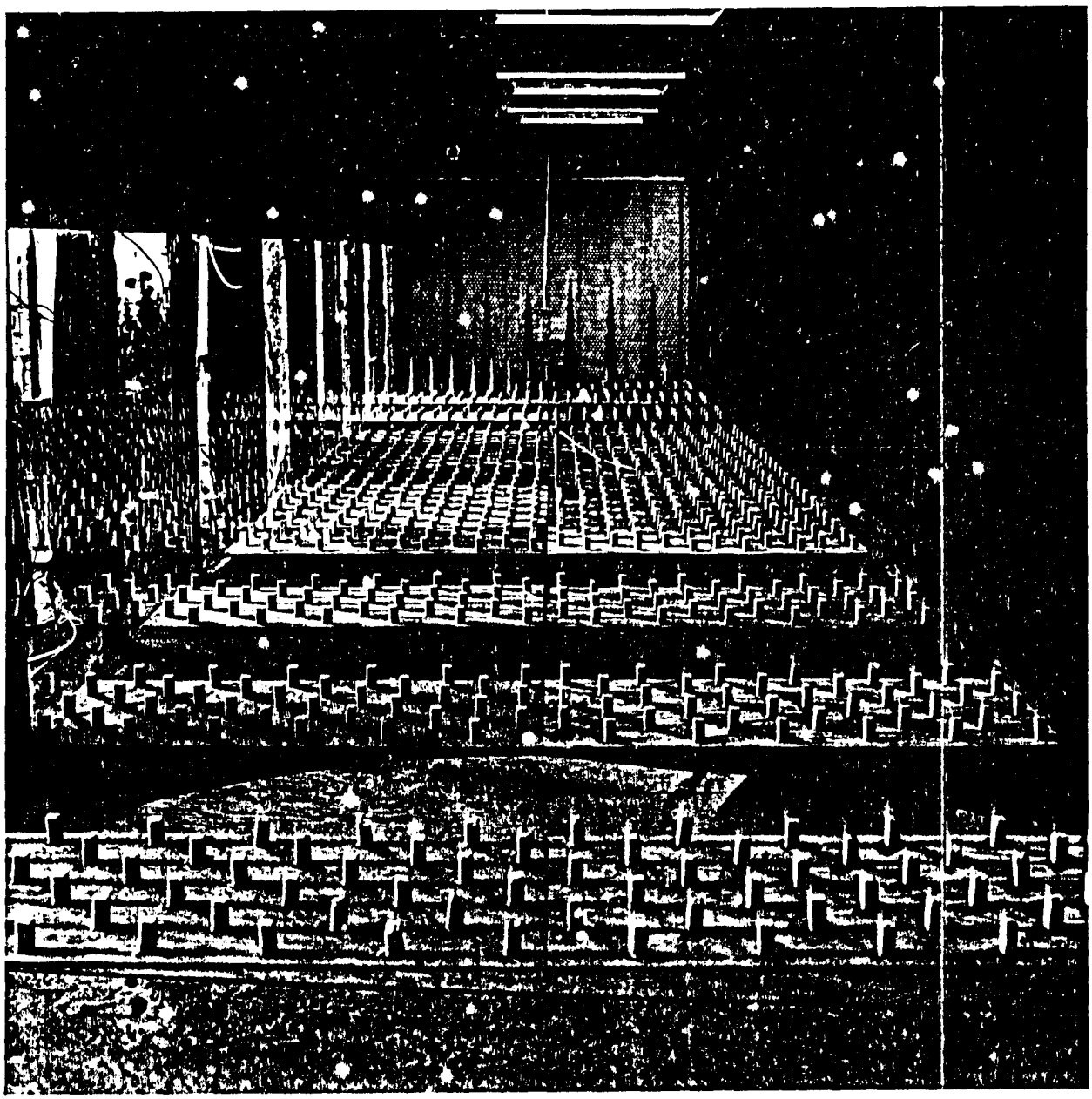


FIG. 4. FULL LENGTH VIEW OF TUNNEL ROUGHNESS LOOKING UPSTREAM FROM MODEL POSITION.

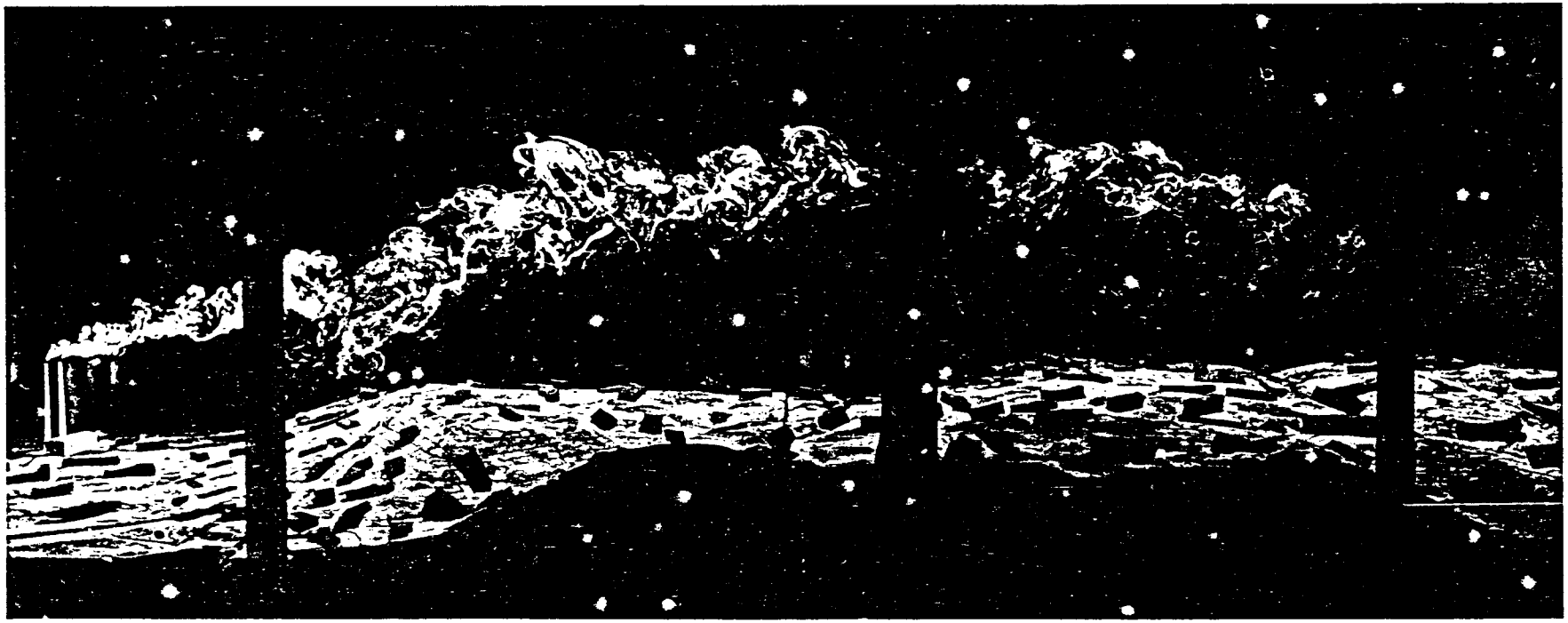
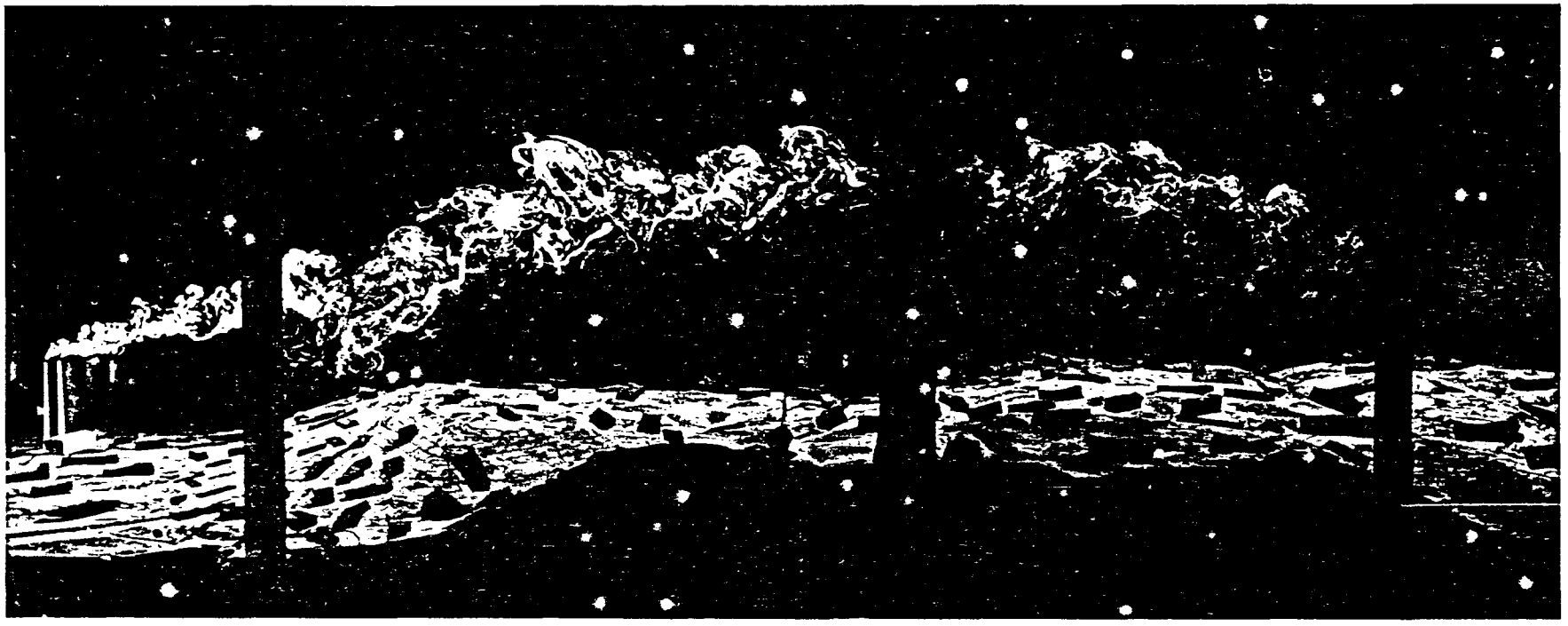


FIG. 5. TYPICAL FLOW VISUALIZATION PHOTOGRAPH USING CHEMICAL SMOKE INJECTED INTO A SIMULATED BUOYANT PLUME FROM A POWER PLANT STACK.



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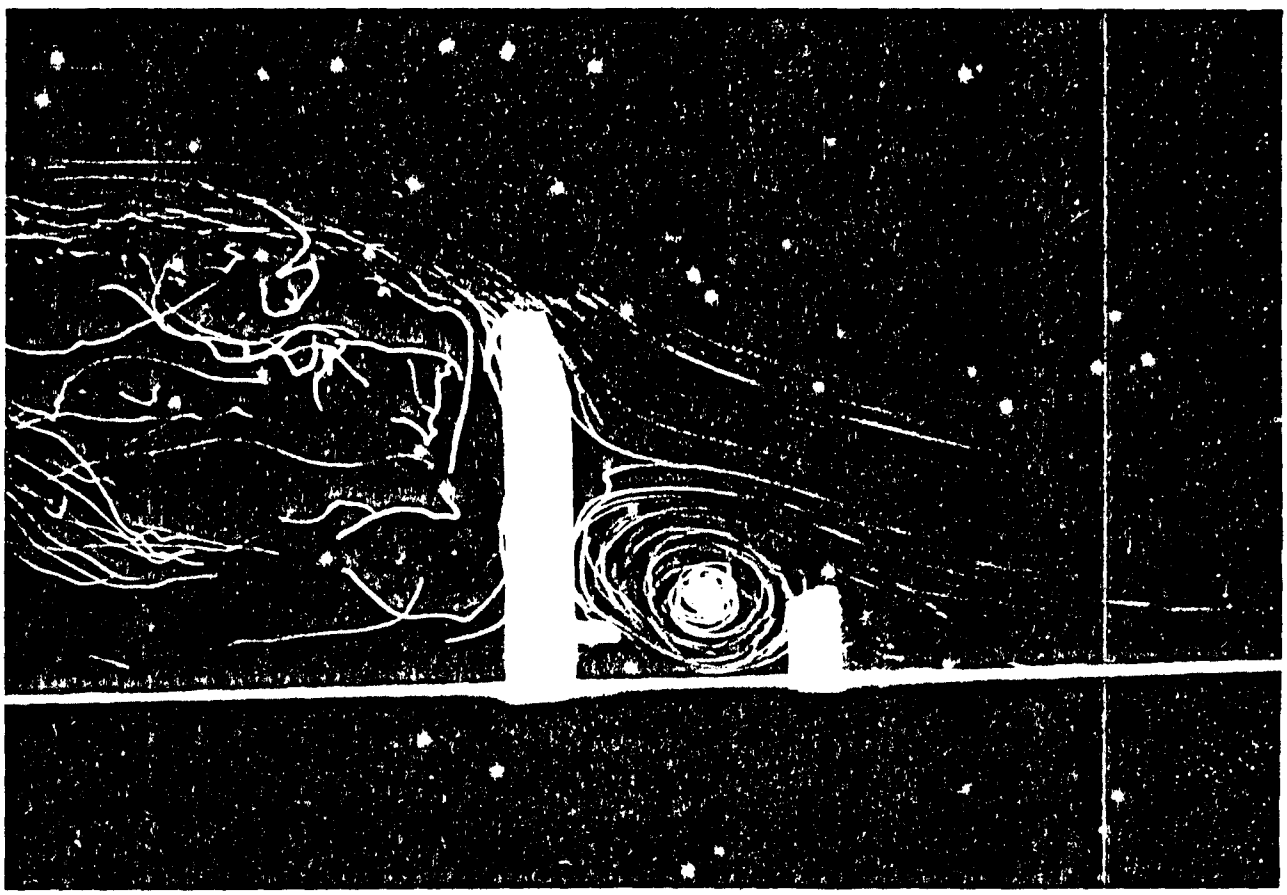


FIG. 6. ILLUSTRATION OF FLOW VISUALIZATION USING NEUTRALLY BUOYANT BUBBLES (FLOW FROM RIGHT TO LEFT).

connected to a pump and collector. Thus, running time is usually less than 5 min per configuration, allowing maximum stability of the tunnel and a high degree of accuracy. A hydrocarbon flame ionization detector is then used to measure tracer gas concentrations gathered through the sampling system at each location downwind of the wind tunnel model sources. When referred to a known source strength, these measurements provide concentration values over the full range of wind directions, wind speeds, and source flow rates used in a particular test program.

Velocity and Turbulence Measurements

Conventional hot wire anemometers and associated electronic control circuitry are used for measuring localized velocity and turbulence. BBN fabricates its own sensors and thus has great flexibility in the design and placement of such sensors on a model. Typically, about 20 sensors are located on a model for mapping street-level winds.

Loads and Pressure Measurements

When structural loads are of interest, information can be obtained by multiple static pressure taps, or by miniature sixth-degree-of-freedom force balances. The force balance technique is one which was pioneered by BBN and enables rapid determination of overall loads and moments on a building, or a section of a building, as a continuous function of wind direction, thus providing a rapid identification of problem areas for more detailed study. Pressure surveys are done using a 48-position programmable valve ("Scannivalve"), which has an internal pressure sensor and small tubes connected to pressure ports on the model of interest. High-frequency dynamic pressures can be measured using flush-mounted piezoelectric sensors made by BBN's Research Transducer Laboratory.

A Wang 720 Programmable Calculator with output writer is used for automatic, on-line reduction of wind tunnel test data. Additional data processing is done on-line or in our main data reduction facility. The capabilities of our in-house computer system are described in a separate brochure.

Equipment available for on-line recording includes two AMPEX 14-channel tape recorders. On-line or laboratory analysis of frequency and correlation information is done using Nicolet Omniferous 400A 2-channel or Spectral Dynamics SD 360 FFT Analyzers, and a variety of related equipment. Data manipulation and graphic display are done on our new TEKTRONIX 4051 BASIC Graphic Computing System, which can be setup to interact directly with the experiment or work from tape-recorded data. This advanced system greatly reduces turnaround time between the experiment and report-ready graphical display of fully analyzed and reduced data.

BBN also has a large in-house computer system and a terminal connecting us to the CDC CYBERNET system (based on the CDC 6600 and 7600 computers). This enables the transfer of data into large programs to obtain CALCOMP plots of velocity, pressure, and pollutant distributions.

Bolt Beranek and Newman Inc.

Bolt Beranek and Newman Inc. creates and applies technology.

Through consulting, research, and development activities, we solve important technical problems for clients in government and industry. We also provide assistance in the engineering, testing, and technical operations of complex, large-scale systems. Through two wholly owned subsidiaries, we manufacture and market computer-related products and specialized scientific instruments. Our scientific and technical capabilities encompass two broad areas:

- Information sciences, computer and communication technologies
- Acoustics and environmental technologies.

Founded in 1948 as a consulting firm in architectural acoustics and noise control, BBN has established an international reputation for creating and applying technology related to all kinds of acoustic phenomena—sound, noise, shock, vibration, and ultrasonics. Our work in information sciences and computer technologies was begun in the late 1950's and today accounts for more than half of BBN's total sales.

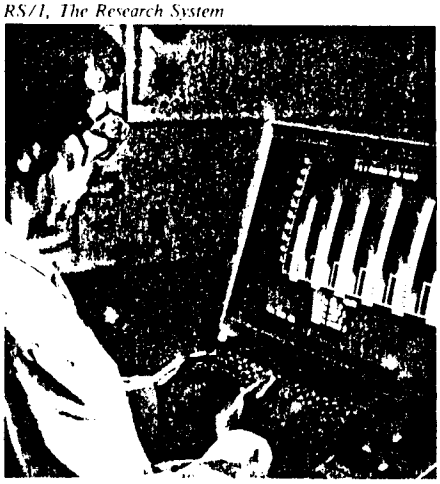
BBN employs about 1000 people, of whom approximately 60% are members of the technical staff. Nearly two thirds of the technical staff hold one or more advanced degrees in such fields as science, engineering, architecture, and business management.

The company's headquarters in Cambridge, Massachusetts, occupy more than 300,000 square feet of office and laboratory space. In addition, BBN serves clients from several regional offices in the United States.

Computer Systems

We have a history of leadership in the design, development, and construction of advanced computer and communications systems. Increasingly, we are putting this experience to work in commercial systems—systems that take full advantage of the advanced technology we create.

RS/1, The Research System



Computer Communications Networks

In 1968, BBN began to develop the ARPANET, the first large-scale data-communications network based on packet-switching technology. The tenth anniversary of our work in packet switching was marked this year by a significant contract renewal for the continuing operation, maintenance, and development of the ARPANET, which now links 64 computer centers and more than 170 computers. Thousands of users have access to this resource-sharing network, which spans Hawaii, the continental United States, and parts of Europe.

Packet switching is the basic technology that led to the formation of Telenet seven years ago. Today, we continue to conduct advanced development of packet-switching hardware and software and to build and implement data-communications networks for corporations and government agencies.

Medical Systems

The BBN-developed PROPHET system is used by more than 250 biomedical scientists at medical research centers around the country to study chemical and biological relationships in a variety of diseases. This computer-based system helps research investigators enter, file, and retrieve information, perform statistical analyses, and manipulate data in graphic or written form. This year, we also implemented a version of the PROPHET system for a large pharmaceutical company.

CLINFO is a system being sold by BBN to clinical investigators with little or no computer experience. The system is organized to correspond to the information-related activities of clinical research, making it easy for users to handle information about patients, employ data-analysis procedures, and display data in convenient graphic forms.

RS/1, The Research System

We have begun to market RS/1, a commercial software product designed to help research scientists store, analyze, and understand their data better. RS/1 features an English-like command language and gives researchers direct and immediate control of their data and analyses in written, tabular, or two-dimensional graphic form. We provide a full range of installation, user training, and support services for the RS/1 system.

The SpaceGraph System

BBN's SpaceGraph system displays computer output in three dimensions and aids in the visualization of spatial structures. SpaceGraph provides true 3-D images, whose perspectives change according to the angle of viewing. SpaceGraph images can be easily created and modified to assist in processes of design and analysis.

The Microprogrammable Building Block

BBN is currently developing an economical, general-purpose minicomputer called the microprogrammable building block (MBB). The MBB is specifically designed to facilitate systems projects, because

it greatly simplifies connection of input and output devices. The MBB can also be used to emulate other computers; thus, software written for obsolete machines can still be used in newer operating systems based on the MBB.

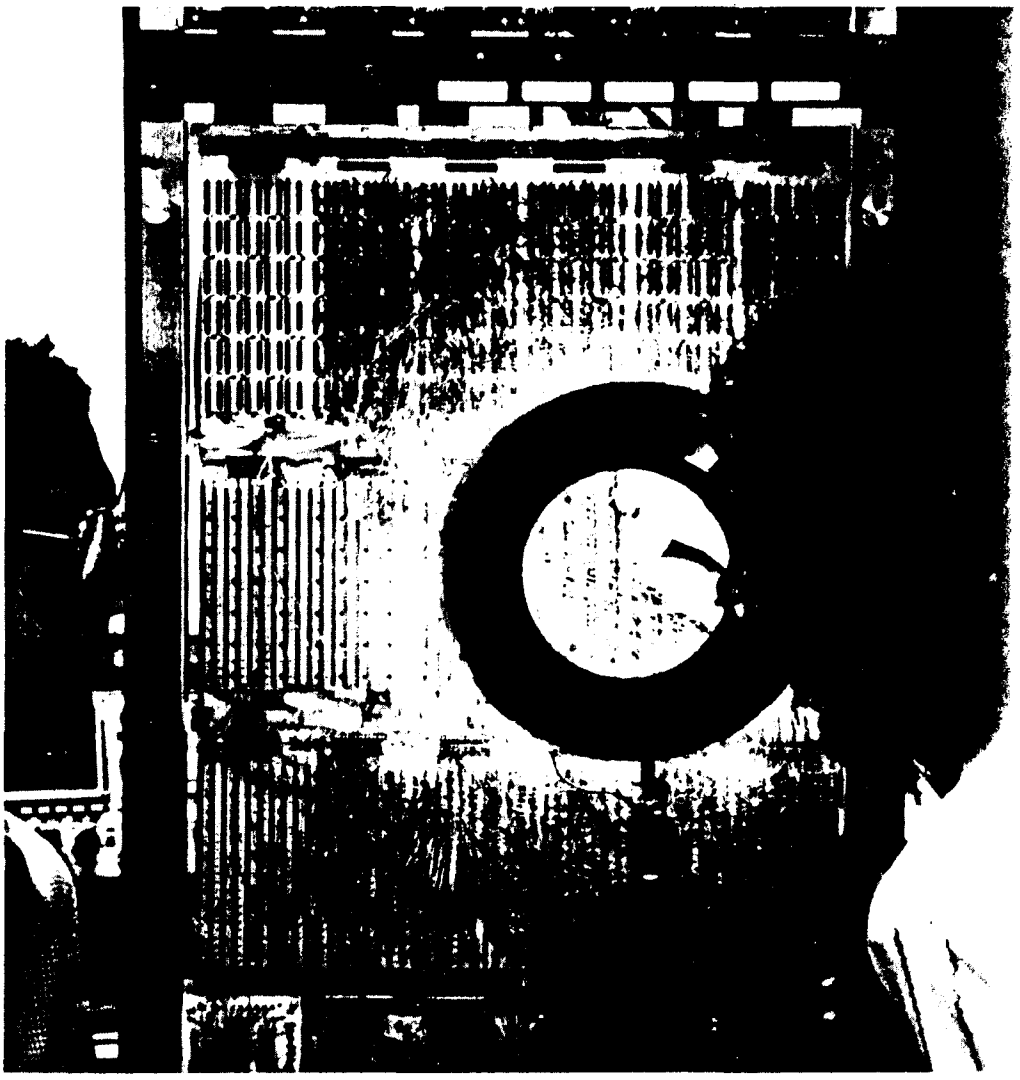
Special Systems

For commercial and government clients, we design, build, and install computer-based measurement and analysis systems. Two continuing projects in this area are a sophisticated signal-analysis system used with underwater sensors and enhancements of the UNIX time-sharing system.

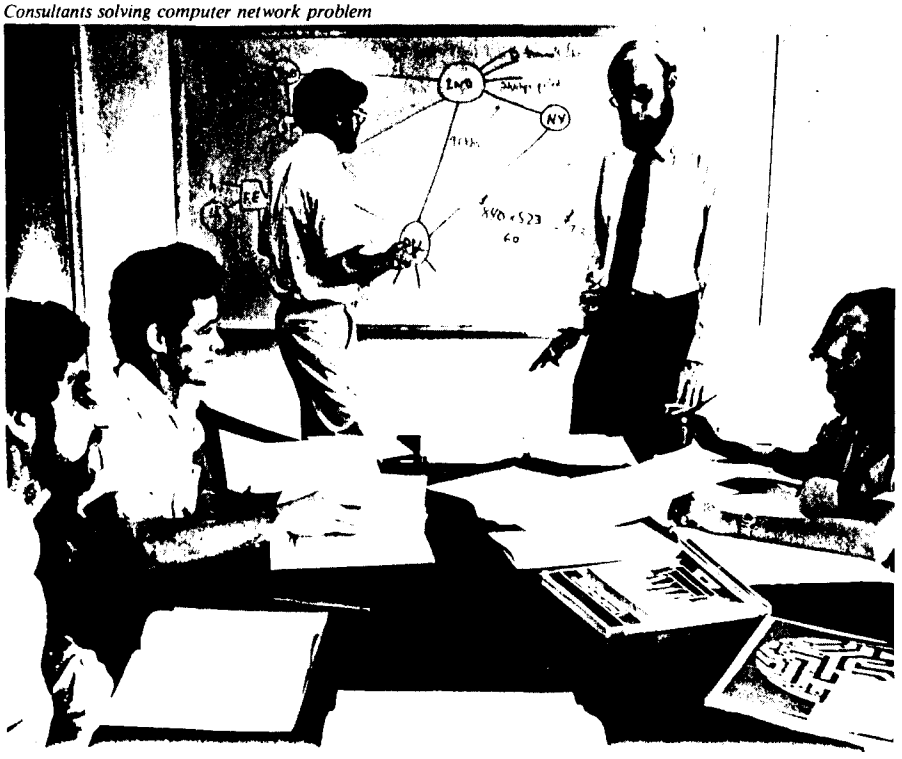
Consulting Services

We provide consulting services, systems studies, and design analyses in computer and communications technology. Our clients include government agencies, airlines, manufacturers, and financial and industrial organizations. Drawing upon BBN's broad experience in computer science and advanced systems development, our consultants provide detailed analyses of a problem, propose an optimized solution, and ensure a smooth transition from a conceptual design to a working system.

BBN's Microprogrammable Building Block nears completion



Consultants solving computer network problem



Assisting Prophet system users

Information Sciences

Information sciences at BBN combine computer and behavioral sciences. We develop new concepts in computer languages, programs, and systems, and we study such basic human capabilities as sensation, perception, learning, reasoning, and memory. The merger of these disciplines provides a unique capability for designing systems in which human beings and machines work in partnership, each complementing the strengths and abilities of the other.

A deaf instructor teaches sign language to BBN scientists developing aids for the deaf

Experimental Psychology

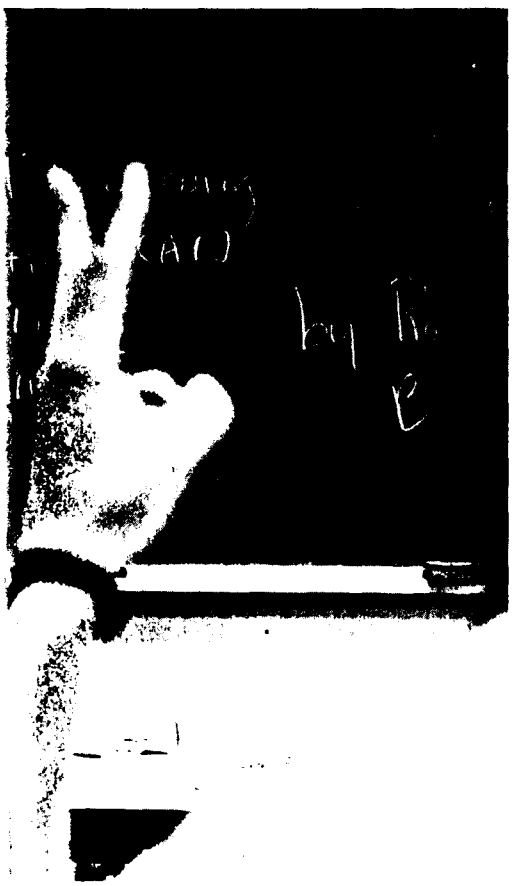
We conduct applied research on human capabilities in producing, transmitting, processing, and using information. These studies address such specific questions as: What factors contribute to poor reading and writing skills? How can the teaching of these skills be improved? We also carry out research on human responses to acoustically and graphically transmitted information.

Machine Intelligence

We develop techniques and systems for enhancing the ability of computers to interact with users in ways that simulate human intelligence. A major thrust of this work centers on developing programs that will allow human beings and computers to communicate in conversational English. We are exploring automated strategies for handling complex problems of computer comprehension of language, as well as more conventional pattern-recognition problems, such as classification of cloud pictures taken from meteorological satellites.

Electronic Mail Systems

We are carrying out several related projects directed at the design, development, and improvement of electronic mail systems. Using computer-based transmission systems, electronic mail combines the advantages of written communications with the speed and convenience of a telephone call. We are identifying features that can make such systems accessible to both new and experienced users. Other projects are concerned with basic questions of enhancing the adaptability of computers to the needs of individual users.



Simulation and Modeling

Piloting aircraft, driving automobiles, and operating other vehicles are tasks that represent complex interactions between human beings and machines. Our research explores ways of mathematically describing these interactions and evaluating operator and machine performance.

Software Systems

Our software specialists address a broad range of issues relevant to distributed computation and communication systems—security, reliability, efficiency, and effectiveness. Our activities include research on improved techniques of sharing computer resources in a network, development of a packet-switched radio network, and applications of advanced technology to office support systems.

Speech Studies

Our combined strengths in acoustics and computer technologies provide an exceptional research capability in the analysis and synthesis of speech. This work focuses on such questions as how to measure speech intelligibility in a noisy environment, how to preserve the quality of speech transmitted over narrowband channels, and how to synthesize human speech.

Aids for the Handicapped

We conduct research studies to identify ways in which computer technology may be applied to improve educational, vocational, and social opportunities for people with various kinds of handicaps. We have developed computer-based systems for teaching speech to deaf children and evaluated such systems in use to determine how they might be made more effective.

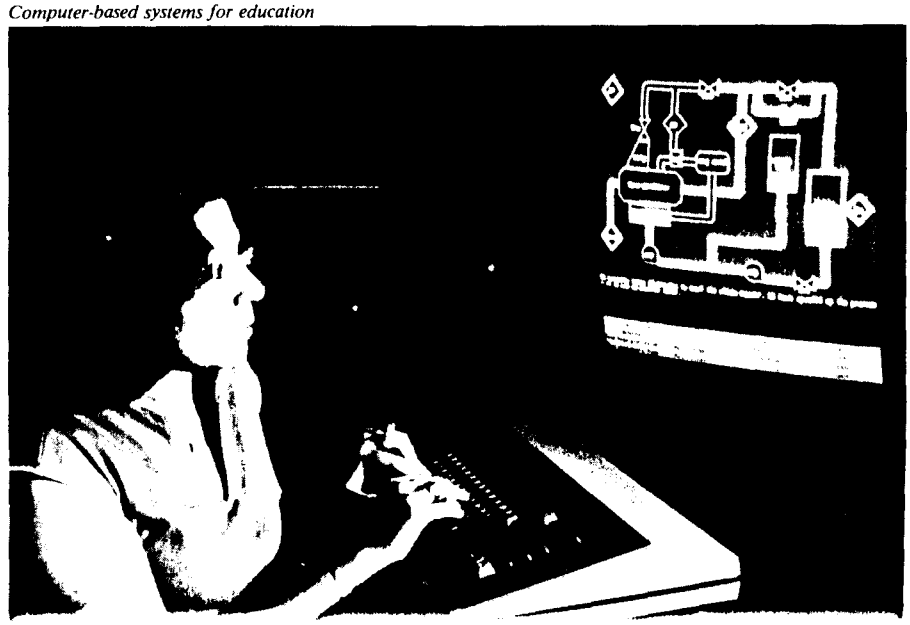
Education and Training

In the field of education, our scientists investigate methods for improving practices and procedures by the use of science and technology. Our efforts center on applications of computers in education and on the development of programming languages for teaching specific skills.

BBN designs electronic mail software

Research on children's reading problems

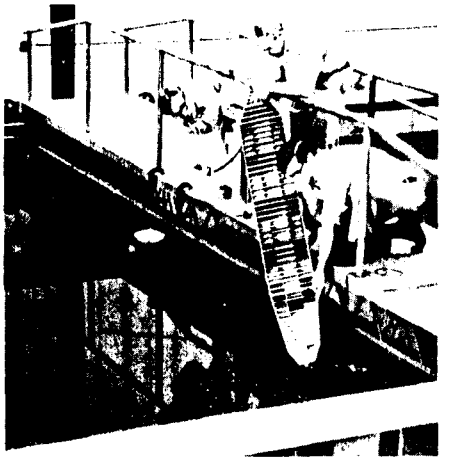
Computer-based systems for education



Underwater Technologies

Problems of working in the ocean have to be approached from the standpoint of a total operating system. This approach includes consideration of men and machines working in extremely close quarters, as well as of the ocean environment itself. Our experience encompasses the study and application of acoustic principles as they relate to all aspects of underwater sound propagation and ship-related noise problems.

BBN's underwater sound lab



Sonar Acoustics

We conduct research and development in advanced sonars for submarines, surface ships, and aircraft. Our sonar-related work encompasses the full range of analysis, design, experiments, at-sea testing, and engineering support. Our capabilities in design and performance assessment draw upon knowledge and skills in underwater acoustics, naval architecture, marine engineering, materials and structures, transducers and arrays, and computer-based signal processing. These capabilities provide the basis for an integrated approach to sonar systems development by minimizing environmental effects and enhancing signal reception.

Shipboard Noise

For naval surface vessels and submarines, commercial ships, and pleasure craft, we provide noise and vibration control. These services include prediction and measurement of shipboard noise and vibration, design of control treatments, development of specifications, construction monitoring, and acceptance testing. Experience in ship design, ocean-worthy materials, and special control techniques enable us to provide cost-effective solutions to problems involving habitability, comfort, and communication.

Marine Science

Our work in the design and development of high-performance ships and underwater vehicles is based on an integrated approach to machinery systems, hull and propulsion hydrodynamics, and associated sonars. Our efforts have produced propeller designs that combine quiet with hydrodynamic efficiency and hull and sonar dome designs that result in low noise. We are currently working on new propulsion machinery with improved cost/performance benefits.

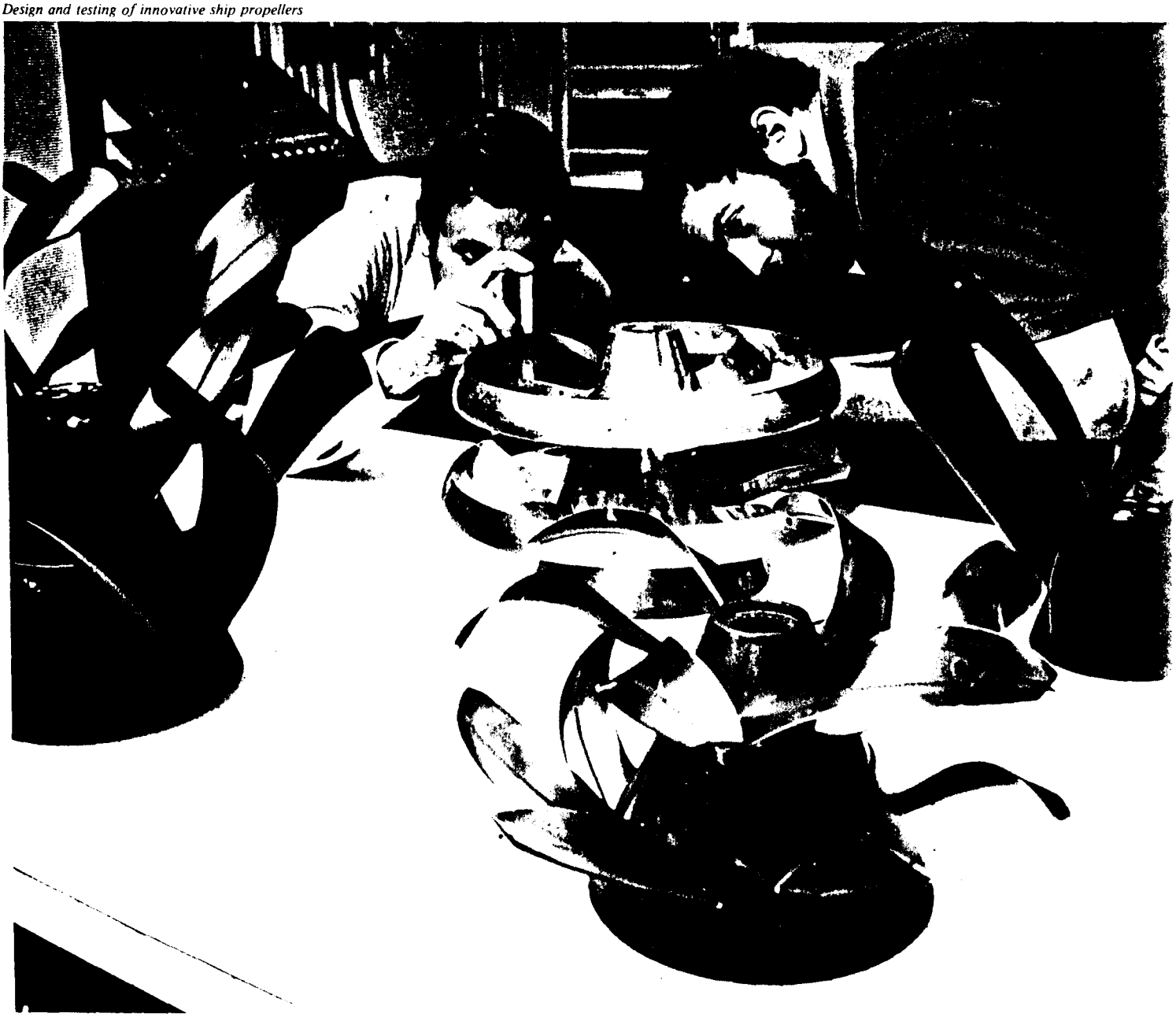
Naval Systems Support

The defense capabilities of the U.S. Navy rely heavily on acoustic detection and identification of ships and submarines. BBN's engineering support for naval programs significantly enhances this important capability. By combining technical and program management skills, we assess and forecast the operational performance of complex naval systems involving ships, aircraft, sensors, and communication systems.

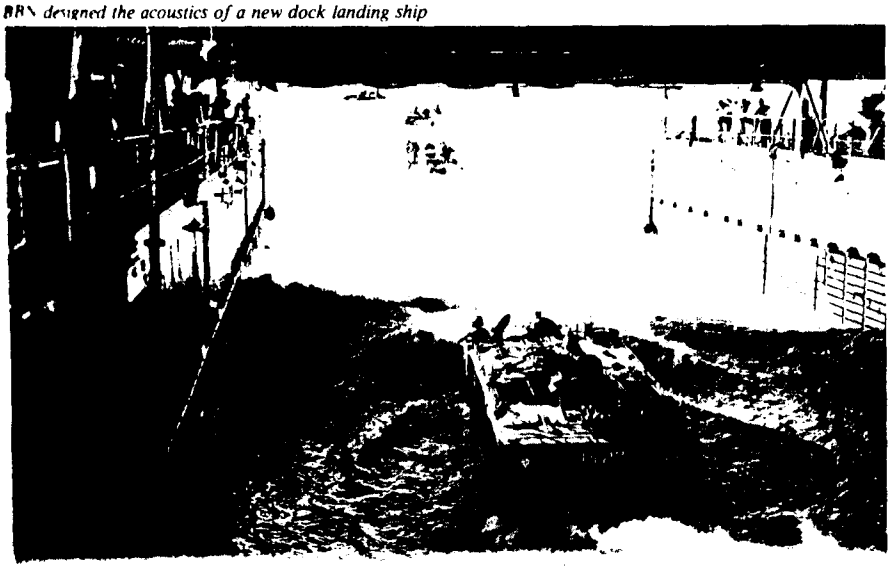
Marine Systems

We provide review and evaluation services for the acoustic design of ships and shipboard systems. We review specifications, analyze functional requirements, and provide acoustic measurement and other on-site evaluation services during the testing phases of new ships.

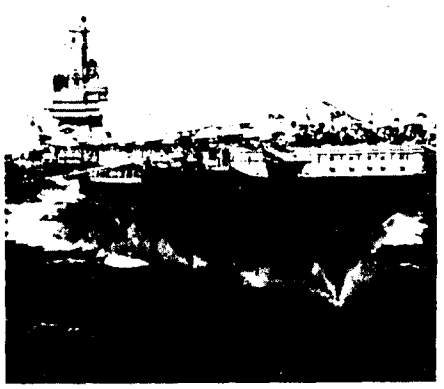
Design and testing of innovative ship propellers



BBN designed the acoustics of a new dock landing ship



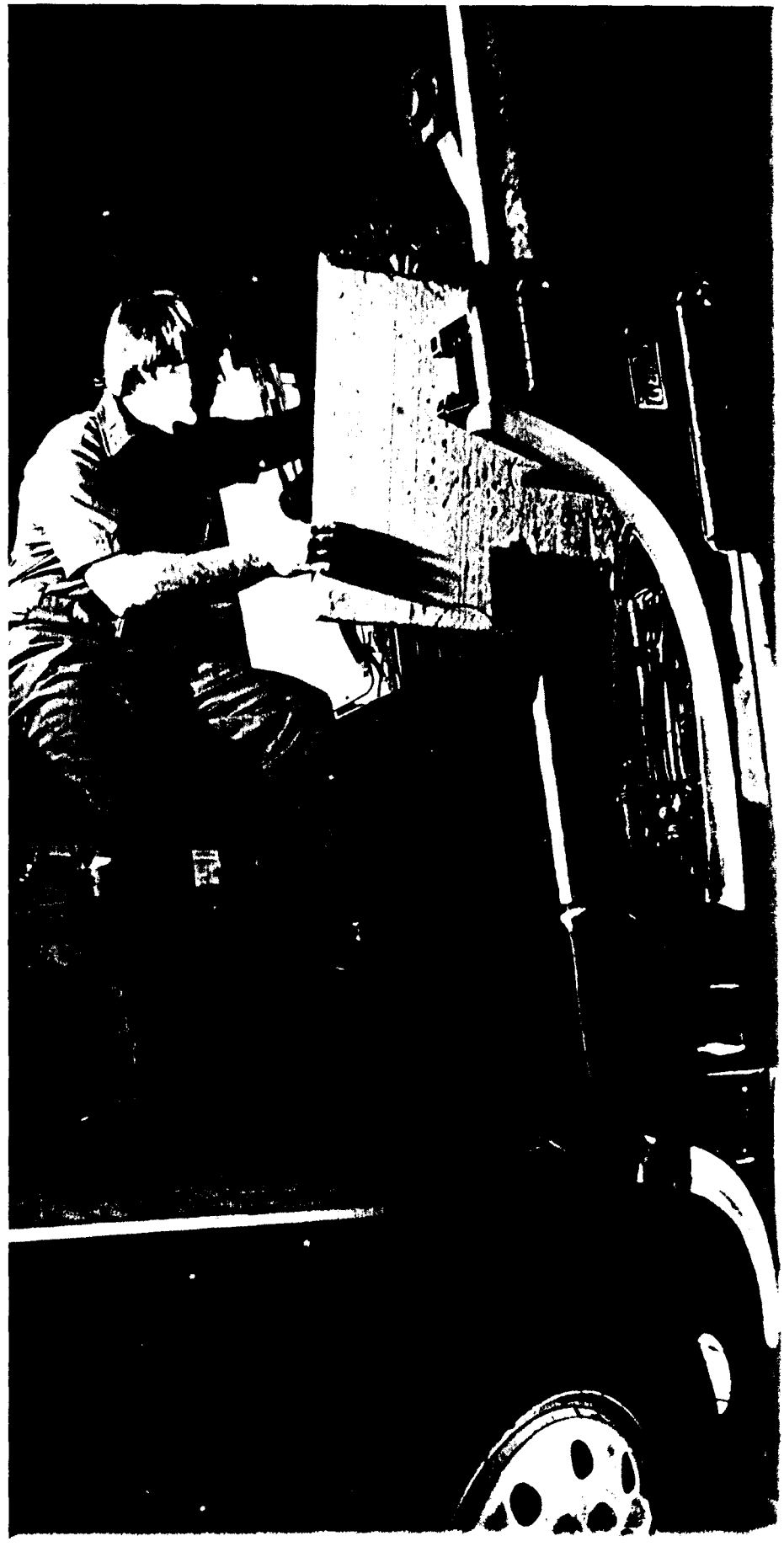
BBN conducted acoustic tests on the USS KENNEDY



Environmental and Noise Control Technologies

Wherever people live and work, their well-being is affected by the noise they are exposed to and the air they breathe. Our consulting, research, and development services focus on the prevention of environmental problems through scientific planning and the solution of environmental problems through engineering analysis and the design and application of suitable controls.

Noise control for trucks



Noise and Vibration Control

We solve noise and vibration problems for factories, utility companies, manufacturers, and industrial organizations. We provide measurement and analysis services and recommend techniques for controlling noise and vibration. For proposed new facilities, we identify potential problem sources, design appropriate treatments to meet acceptable noise and vibration criteria, and offer engineering supervision to ensure that recommended control measures are properly carried out and that specified criteria are satisfied.

Community Noise and Air Quality Analysis

Communities near airports, highways, rail lines, or industrial facilities sometimes face combined noise and air quality problems. We help companies and transportation authorities reduce the impact of their operations on nearby communities. Working with community officials, we assist in the development of environmental codes and strategies for the enforcement of environmental regulations.

Industrial Hygiene and Safety

We help companies understand and comply with occupational safety and health regulations. Our staff of industrial hygienists is experienced in air sampling and analysis techniques and in the evaluation of exposures to toxic substances. We have designed control treatments to protect workers, assisted in the establishment of safety and health programs, and trained individuals to carry out such programs in their own plants and facilities.

Environmental Impact Analysis

We develop environmental impact statements for proposed new construction projects and work with planners to minimize undesirable side effects, both during and after construction. In addition to analyzing effects on the physical environment, we evaluate sociological and economic impacts. We provide expert testimony in environmental matters and serve as consultants to commercial organizations as well as to federal, state, and municipal authorities.

Economics

For clients in government and industry, we assess economic impacts of technological change and evaluate the economic consequences of alternative approaches. Our areas of specialization include economic analyses in fields of noise and pollution control, product development, transportation, and energy.

Energy Studies

We combine scientific and engineering capabilities to develop energy-conservation techniques, to test these concepts in practice, and to evaluate their potential for broader application.

Product Quieting

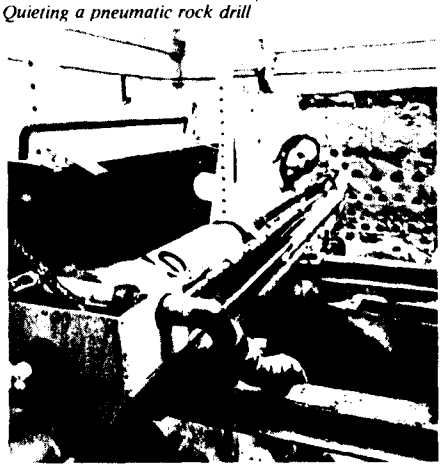
Quiet products often enjoy a competitive advantage over noisier ones. Manufacturers have come to depend on our product-quieting services for including noise control as an integral part of product design. Our services have been used to reduce noise from trucks, heavy machinery, and consumer household items.

Aerosciences

We conduct research in aerodynamics and physical acoustics. Results of this work provide new understandings of basic mechanisms. These insights have been applied in the design of advanced aerospace systems and quieter equipment and structures, as well as in analyses of wind dispersal of power-plant stack effluents.

Designing noise barriers for a rapid transit system

Quieting a pneumatic rock drill



Using sound to locate sources of energy loss

Industrial hygienists conduct analysis

Architectural Technologies

The size and shape of a room, the finish materials, the furnishings—these and many other elements combine to determine how people will hear sounds inside a space. We have to understand these complex interrelationships to ensure that the acoustic character of a space is suitable for its intended use, to design quality sound systems, and to control noise from sources inside or outside the building.

Computer-aided design of loudspeakers

Architectural Acoustics

Our acoustic design and consulting services are used to enhance sound within a space, to improve speech intelligibility, to ensure privacy, or to reduce noise intrusion. Our experience covers all types of buildings—offices, schools, churches, and auditoriums and theaters, as well as such special-purpose spaces as concert halls, film and recording studios, music rooms, and audio-visual facilities. Our services include the specification of acoustic criteria, design recommendations to meet the criteria, and supervision of installation of critical acoustical elements.

Acoustic consulting for open-plan offices is an increasingly important new part of our business. Computer-aided design programs developed by BBN allow us to explore many different possibilities for room layouts and furnishings and to recommend the most acoustically suitable alternatives to fit the particular needs of each client. We also design sound-masking systems that enhance acoustical privacy by providing appropriate levels of carefully controlled background noise to mask intruding speech.

Noise and Vibration Control

Our consultants solve noise and vibration problems caused by heating and air-conditioning systems, elevators, power generators, and other mechanical and electrical systems in buildings. By assisting in the early stages of planning a new building, we can prevent such problems. We also design control treatments for existing buildings, where problems have appeared owing either to poor initial design or to faulty construction. In addition to design and control services, we offer guidance in the selection of equipment and hardware, the review of shop drawings, the inspection of installations, and final acceptance tests.

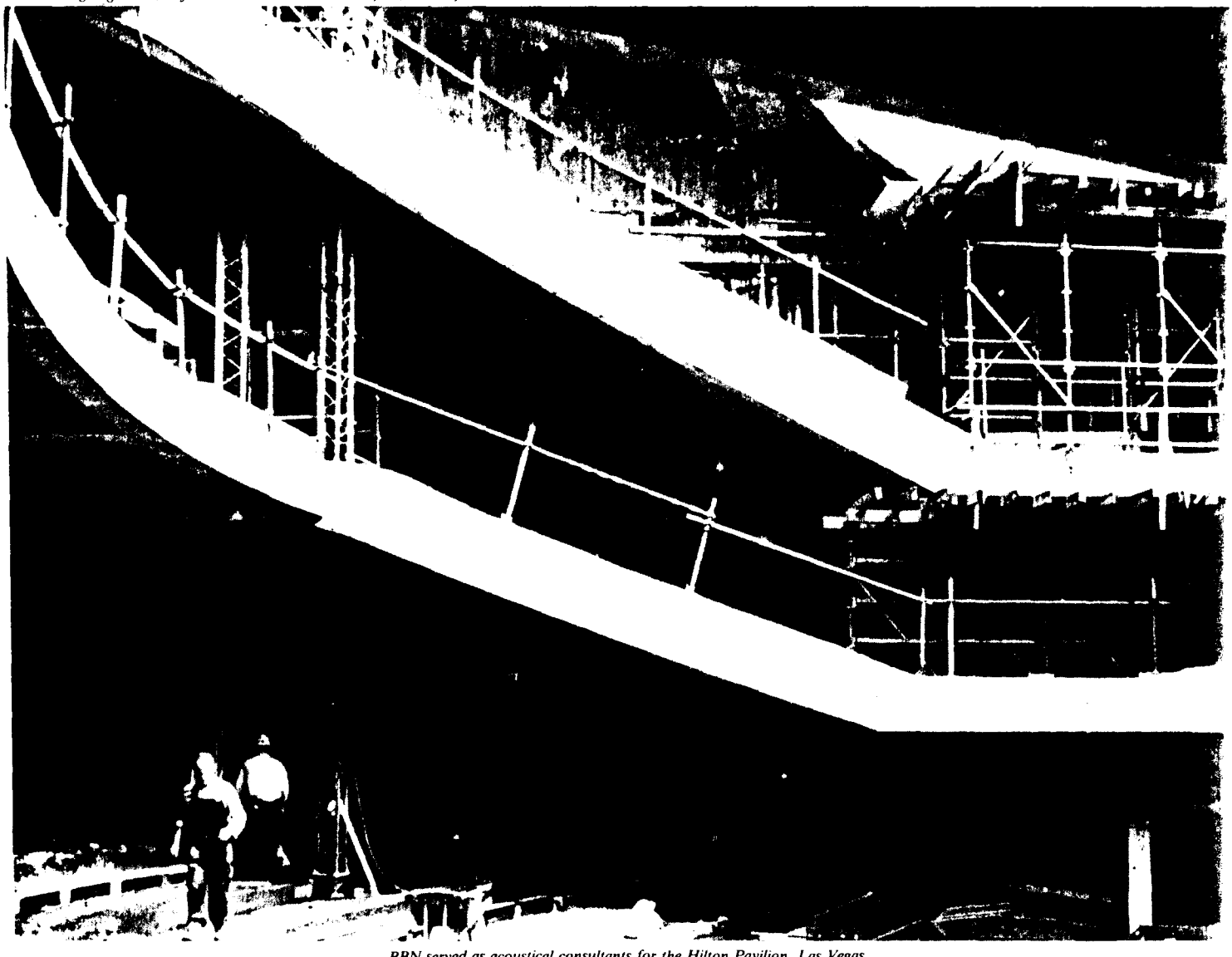
Sound Systems

In the design of sound-amplification systems, we analyze functional requirements of performance criteria, coordinate design with the architecture of the space, prepare drawings for specification and bidding, provide cost estimates, review bids, supervise installation, perform acceptance testing, and train personnel to operate the system. By integrating sound-system design with the overall acoustic character of the space, we achieve exceptional standards of performance with practical, cost-effective systems.

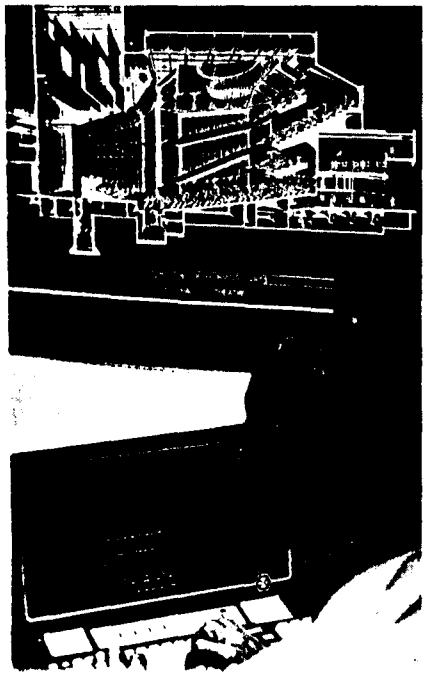
Other Consulting Services

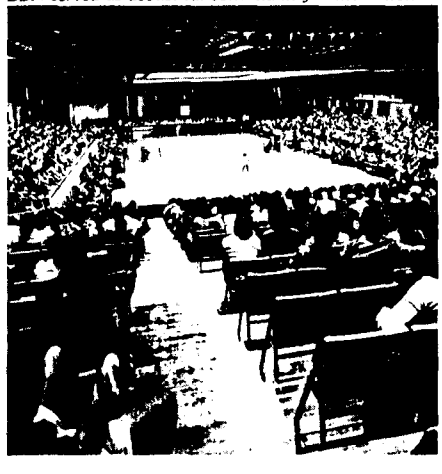
We offer specialized consulting services to assist in the planning and organization of theaters, concert halls, art galleries, audio-visual facilities, exhibition spaces, and TV studios. These services include technical and economic feasibility studies and facilities planning to meet functional requirements.

BBN is designing acoustics for the Victorian Arts Centre, Melbourne, Australia



BBN served as acoustical consultants for the Hilton Pavilion, Las Vegas





BBN's OPLAN program assists in the design of open-plan offices

BBN Computer Corporation

The BBN Computer Corporation, a wholly owned subsidiary, manufactures and markets computer-related products based on technology emerging from our research and development activities. The initial markets for these products will be in computer communications, a field in which dramatic growth is anticipated.

Testing a Pluribus panel

The Pluribus Multiprocessor

The BBN Computer Corporation manufactures and markets the Pluribus computer, a high-speed multiprocessor used as a message-switching node in packet-switched data-communications networks to provide extreme reliability and very high bandwidth. The basic technology for this system was originally developed for the ARPA Network of research computers; it has now been modified and used successfully in other communications networks for government and commercial organizations.

In the years ahead, we expect to see a significant increase in the demand for computer-based networks to handle data-communications needs of computer service companies, large corporations, university and research groups, and government agencies. Packet-switching technology, because of its ability to provide rapid, reliable, and economical communications among geographically distributed computers and terminals, will be a key factor in this growth. The Pluribus family of products is well-suited to many of the applications that we foresee, and we expect the demand for these products to increase.

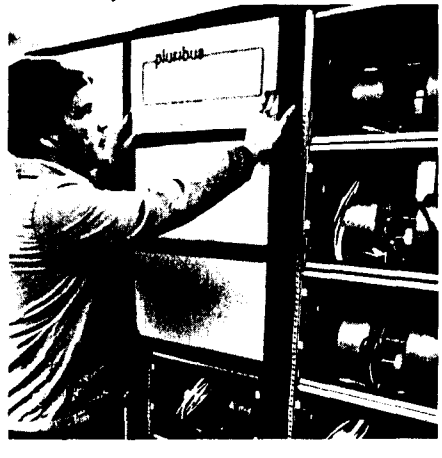
Quality control

Wire wrapping

Pluribus manufacturing facility

Cable assembly

Final assembly



New Products

In addition to the Pluribus multiprocessor, the BBN Computer Corporation will be developing and introducing new computer products to the market. The first new product, scheduled for introduction later this year, is the Microprogrammable Building Block (MBB). This economical, general-purpose minicomputer can be programmed to emulate other computers and is specifically designed to facilitate systems projects, such as communications networks.

BBN Instruments Corporation

Scientists at BBN first developed transducers and noise measurement equipment to solve difficult field measurement problems encountered by our engineers and consultants in their day-to-day work for clients. The technology created from these efforts is now available as a standard family of products, engineered, manufactured, and marketed by BBN Instruments Corporation. Our products reach increasingly broad markets that demand dependable, cost-effective instrumentation.

Manufacturing accelerometers

Accelerometers

BBN accelerometers are used to measure shock and vibration in a wide variety of industrial, medical, military, and general laboratory applications. Extremely high performance makes these devices well-suited to research and product testing, while their reliability and rugged construction make them ideal for applications in demanding situations, such as check out of aerospace systems, testing of underwater vehicles, and monitoring of rotating machinery.

BBN piezoelectric accelerometers feature built-in electronics, resulting in advantages of economy, lower noise, and ease of application.

We manufacture miniature accelerometers whose accuracy, signal-to-noise ratio, frequency response, and light weight are unexcelled in the industry, as well as standard-size units designed for extremely hostile environments.

The 614 Portable Noise Monitor

The Model 614 is a simple-to-operate, self-contained portable noise monitor with automatic, on-site calculation and printout of airport, community, traffic, and industrial noise levels. This weather-proofed unit operates over a wide temperature range, -10°C to +50°C, for up to seven days of unattended monitoring.

Designed to meet a variety of international, federal, state, and local requirements, the Model 614 automatically calculates and prints average or instantaneous sound levels at programmed intervals. The printer may be programmed from the front panel to print data during a number of convenient time periods, ranging from every 10 seconds to 24 hours.

Single-event recording can also be programmed, thus permitting the evaluation of short-duration signals, such as an individual aircraft flyover.

Special features include a rechargeable battery pack that can be replaced in the field without loss of data and an automatic shutdown in the event of low battery power to prevent accumulation of incorrect data.

New Products

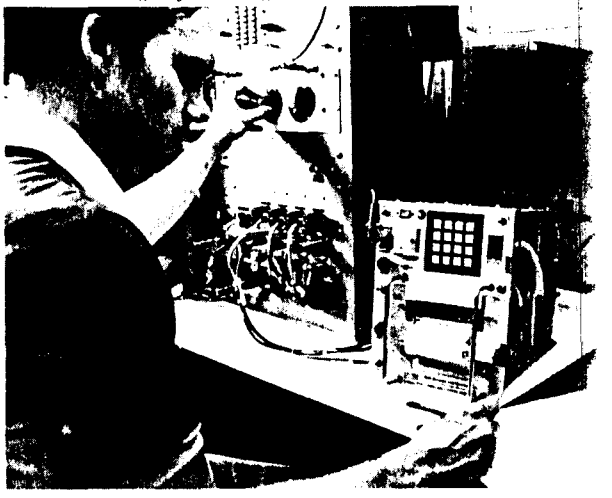
Several new products are currently being introduced. These include:

- A family of hand-held vibration analyzers—digital instruments that measure and display the output of BBN's accelerometers.
- A family of medium-temperature (288°C) accelerometers.
- A shock accelerometer capable of measuring peak forces ten thousand times the force of gravity.
- A high-temperature (375°C) accelerometer built to operate in the high-radiation environment of a nuclear reactor.

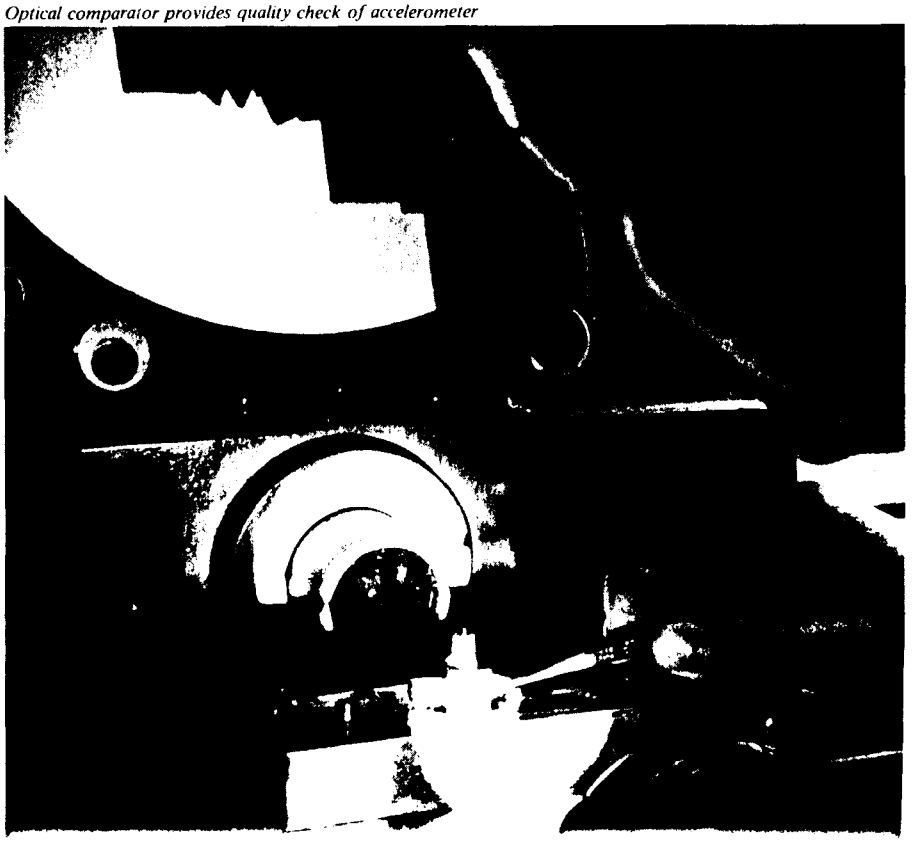
Other new products are scheduled for introduction late in fiscal 1980.

The 614 Portable Noise Monitor

Model 614 undergoes final testing



Optical comparator provides quality check of accelerometer



Company Background

Bolt Beranek and Newman Inc. was started in 1948. The company began as a partnership of two scientists, Richard H. Bolt and Leo L. Beranek, providing consulting services in acoustics. Robert B. Newman joined the partnership in 1950. With the post-war building boom and the advent of jet aircraft, acoustics proved to be a fertile field for scientific problem-solving services in the 1950's. As other scientists joined the company, the partnership was incorporated in 1953 and later became a publicly held corporation in 1961.

Acoustics has long been a major crossroad of the sciences, combining aspects of mechanics, electronics, aerodynamics, physiology, psychology, and other technical disciplines. This mix of scientific interests was important in the early growth and diversification of BBN, leading it first into a wide range of activities involving consulting, research, and development in acoustics and later into the fields of computer technology and information sciences.

By the 1970's, the depth and breadth of BBN's scientific capability had brought the company into international prominence as a major innovator in acoustics, computer technologies, and information sciences. BBN enjoys a reputation as an organization of outstanding specialists accustomed to working at the forefront of science and technology in projects that demand a melding of many different technical disciplines. This capability has enabled BBN to contribute importantly to the development of computer time-sharing and packet-switching communications technology, as well as to such historically significant investigations as the 18½-minute gap on the Watergate tapes, the shootings at Kent State, and the assassination of John F. Kennedy.

Many of our technical staff members are internationally recognized leaders in their fields of specialization. BBN's strength as a company lies in its ability to attract exceptional scientists and engineers by providing a working environment in which they can pursue advanced research as well as participate in the application of results to solve practical problems. It is this strength that has for more than thirty years enabled BBN to contribute both to the advancement of science and the achievement of national goals.

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

B/c Wind Tunnel

September 2, 1980

SEP 16 Rec'd

Mr. Richard E. Hayden, Manager
Aero Sciences Department
Bolt, Beranek and Newman, Inc.
50 Moulton Street
Cambridge, Massachusetts 02138

Dear Mr. Hayden:

Earlier this year, you submitted a proposal to The Architects Collaborative, Inc. (TAC) to assist them in identifying the mitigating wind problems which have arisen in our Health Sciences Center on the Minneapolis Campus. We placed the project on hold pending certain decisions on a proposed new University Hospitals Renewal Project.

We are now interested in a proposal from your firm to conduct an investigation of wind conditions in the University's Health Sciences area and to propose solutions that would involve your working with Ellerbe/HOK, the consultants for the University Hospitals Renewal Project and the Architects (TAC and HSAE) on the other buildings in the center. Possible additions to your previous proposal would include an analysis of and recommendation for solutions in the movement of toxic exhaust fumes emanating from Unit K/E, Diehl Hall and the location of outside air intakes in the design of the new University Hospitals Project.

I would appreciate your response to this request as soon as possible.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH/hd

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455
(612-373-2250)

September 2, 1980

Dr. F. Durgin
Wright Bros. Wind Tunnel Lab
Massachusetts Institute of Technology
Cambridge, Mass. 02139

Dear Dr. Durgin:

I have been informed that you have a very complete wind tunnel and laboratory suitable for analysis of ground effects of winds on and near buildings and that you may be interested in performing a fairly unique study for the University of Minnesota for a portion of the Minneapolis Campus.

Briefly stated, the problem involves extreme wind conditions in an open plaza of the Health Sciences area of the campus. Recent construction of three high rise buildings has exacerbated this condition to the point that we must barricade and guard the plaza several days each winter to prevent pedestrian access and possible injury.

Enclosed is a plot plan showing the existing buildings and the proposed new 10-story replacement hospital to be constructed at the south end of the plaza. Also enclosed is a photo of a mass model of the buildings (with skins removed to show floor levels).

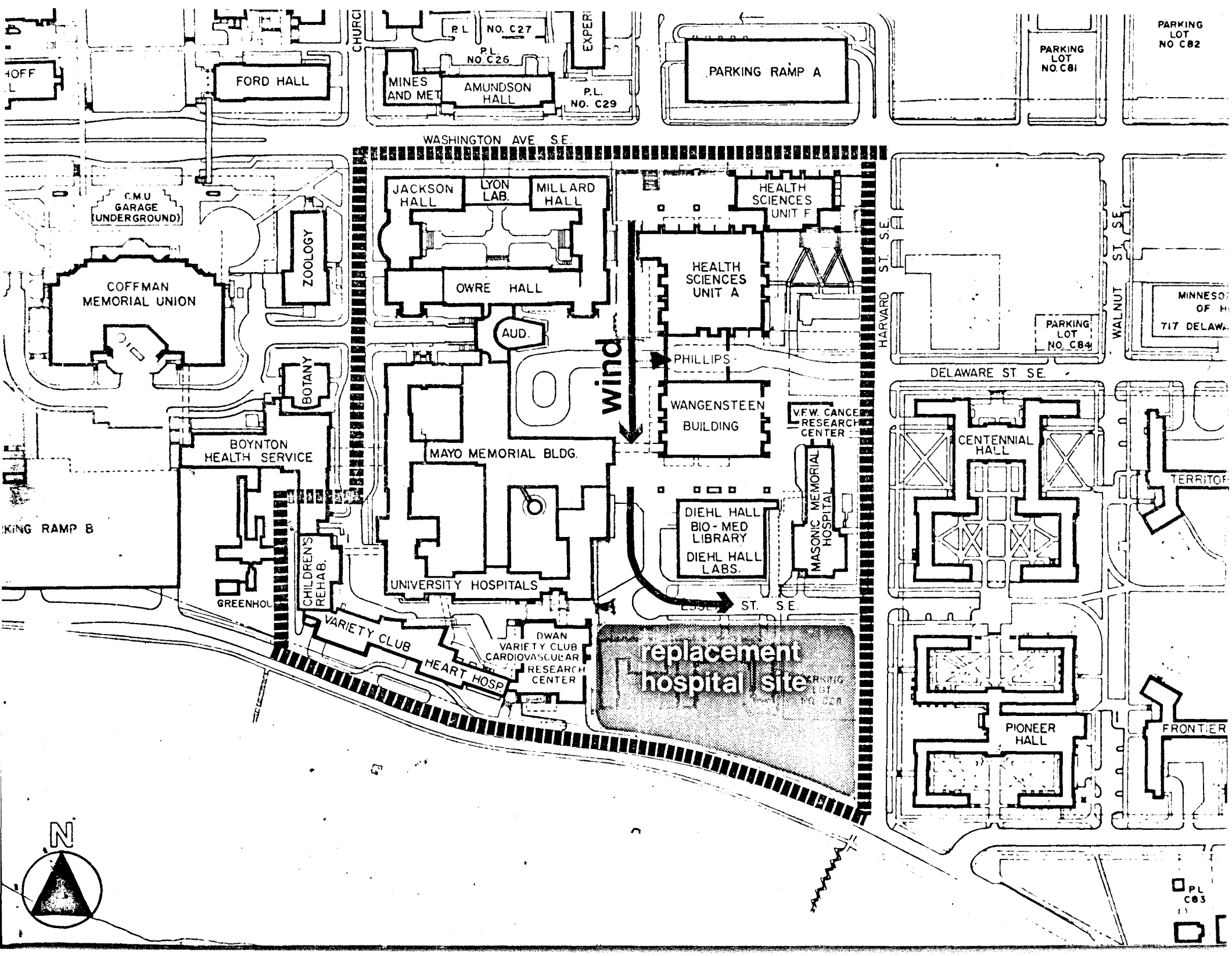
Would you be interested in performing an analysis of this problem including potential effects the new building will have? If so, we would furnish whatever information you require to prepare a proposal, including schematic designs of the new hospital. The timetable for such a study is rather short, as we are anticipating completion of design development by December of this year.

Please call my office to discuss your availability to conduct such a study.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH/hd


FORD HALL
MINES AND MET
AMUNDSON HALL
P.L. NO. C26
P.L. NO. C27
P.L. NO. C29
PARKING RAMP A
PARKING LOT NO. C81
PARKING LOT NO. C82
WASHINGTON AVE. S.E.
C.M.U GARAGE (UNDERGROUND)
COFFMAN MEMORIAL UNION
ZOOLOGY
JACKSON HALL
LYON LAB.
MILLARD HALL
OWRE HALL
AUD.
HEALTH SCIENCES UNIT F
HEALTH SCIENCES UNIT A
HARVARD ST. S.E.
WALNUT ST. S.E.
PARKING LOT NO. C84
DELAWARE ST. S.E.
PHILLIPS
WANGENSTEEN BUILDING
V.F.W. CANCER RESEARCH CENTER
BOTANY
BOYNTON HEALTH SERVICE
MAYO MEMORIAL BLDG.
wind
CENTENNIAL HALL
DIEHL HALL BIO-MED LIBRARY
DIEHL HALL LABS.
MASONIC MEMORIAL HOSPITAL
CHILDREN'S REHAB.
UNIVERSITY HOSPITALS
VARIETY CLUB HEART HOSP.
DWAN VARIETY CLUB CARDIOVASCULAR RESEARCH CENTER
replacement hospital site
PIONEER HALL
N

File
B/C Wind Tunnel
Analysis

THE ARCHITECTS COLLABORATIVE INC.

10 October 1980

Mr. Clinton N. Hewitt
Assistant Vice President
Physical Planning
University of Minnesota
340 Morrill Hall
100 Church Street, S.E.
Minneapolis, Minnesota 55455

Dear Mr. Hewitt:

We have been informed by Mr. Hayden of Bolt, Beranek and Newman, Inc. of your request for an expanded proposal to study the wind migration in the Health Sciences Center. We are very pleased to know that the University has decided to proceed with a study.

In previous conversations with the Health Sciences Planning Office we have emphasized the importance of conducting a wind study prior to erecting the fifth floor bridge link between Units 'B' and 'A'. As you are aware our previous proposal for a study submitted with BB & N prior to the design of the link was not accepted by the University. As a result, the contract for erecting the link has been awarded as a part of the Unit B/C Phase V-2 contract without any analysis of its impact on wind migration being undertaken.

Our concern is that the placement of the link in the Delaware Street underpass of Unit B may accelerate the wind experienced there by further restricting the opening through which it may travel. In addition, the entrance solutions which we have explored for Units A and B/C have never been studied for their effectiveness in resolving the wind migration into these buildings.

We would request that the University give immediate priority to an analysis of these issues in their wind migration study, so that steps may be taken, if required , prior to the bridge erection to insure that conditions are improved rather than worsened by this construction.

We would be most pleased to be of any assistance we can in this effort.

Very truly yours,

THE ARCHITECTS COLLABORATIVE, Inc.

John M. Patterson
Senior Associate

JMP/sca

11/11/80

To: Paul Maupin

Fr: Gary Simmons

Proof copy of
Dr. Dugan's wind
study agreement
for your review
and comment
thanks.

DRAFT COPY

UNIVERSITY OF MINNESOTA
TWIN CITIES

Office of the Assistant Vice President

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

NOV 11 1980

November 11, 1980

Mr. Frank H. Durgin, Associate Director
Wright Brothers Wind Tunnel
Massachusetts Institute of Technology
Cambridge, Massachusetts, 02139

Dear Mr. Durgin:

This letter authorizes you to proceed with conducting a ground wind study of the Health Sciences area of the University of Minnesota Twin Cities/Minneapolis Campus.

The scope of services will be as follows:

1. Analysis of the weather bureau records to obtain an estimate of the probability of the wind coming from any direction at each speed at gradient height, i.e. the wind conditions must be determined above the site.

2. Construction of a model of the Health Sciences area; to a scale between 1/300 and 1/600 and which includes all of the surrounding buildings and terrain features on an 8 foot diameter turntable in the wind tunnel.

3. Collect on-site wind data, if desirable.

4. Testing of the model in the wind tunnel in a properly simulated Earth's boundary layer (i.e., in a flow field with the appropriate gustiness and increase in velocity with height). Such testing will be performed both with and without the Renewal Hospital in place to allow an evaluation of the effect of the Renewal Hospital.

5. The results of the study of the weather and the wind tunnel test will be assembled so as to predict what wind speed will be exceeded (2% of the time) at each measuring station. The results of this study will be compared with suggested criteria to determine whether or not the wind exceeded 2% of the time at a given station is or is not excessive. This study will not only indicate if a station is too windy but also what wind direction or directions are most responsible for the windy condition.

6. Furnish at least ten copies of a written report describing the results of the ground wind study and making recommendations for correcting the existing and any anticipated excessive wind problem in the subject Health Sciences area.

For the above services, the University agrees to compensate the consultant on an hourly basis for services and at actual cost for expenses, however, the fee shall not exceed Forty Thousand Dollars ($40,000). Payments to the consultant shall be made on the basis of monthly billings submitted by the consultant. Such billings shall be written, shall include a reasonable explanation for the amount of the billings, shall include the University's purchase order number, and shall be signed by a principal of the firm.

This agreement may be terminated by either party upon seven days written notice. In the event of termination, the consultant shall be compensated for services provided through the date of termination.

This agreement shall be binding upon and inure to the benefit of the University and the consultant and their respective successors and assigns. The consultant shall not assign any interest under this agreement without the written consent of the University.

The consultant agrees not to discriminate against any employee or applicant for employment to be employed by the consultant in the performance of this agreement with respect to hire, tenure, terms, conditions, or privileges of employment, or any matter directly or indirectly related to employment because of race, color, religion, sex, national origin, or ancestry.

If this letter agreement meets with your approval, please sign three copies and return them to this office.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH:jr

APPROVED:

Wright Brothers Wind Tunnel

By _____

Title _____

Date _____

AEROELASTIC AND STRUCTURES RESEARCH LABORATORY
DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE, MASSACHUSETTS 02139

September 19, 1980

Mr. Clinton N. Hewitt
University of Minnesota
Physical Planning
340 Morrill Hall
100 Church St., S.E.
Minneapolis, Minnesota 55455

Dear Mr. Hewitt:

Thank you for your inquiry of 2 September 1980. I was on vacation when it arrived and so was unable to respond to it until this week. Professor Baron called your office on the 15th for that reason. We at the Wright Brothers Wind Tunnel would be quite interested in conducting a ground wind study of the campus area at the University of Minnesota. As you probably know, we have had similar problems at the M.I.T. campus and use of the wind tunnel has proven to be invaluable in solving them.

In general, a wind tunnel study of ground winds involves the following:

(1) An analysis of the weather bureau records to obtain an estimate of the probability of the wind coming from any direction at each speed at gradient height, i.e. the wind conditions must be determined above the site.

(2) Construction of a model of the area of interest -- customarily to a scale between 1/300 and 1/600 and which includes all of the surrounding buildings and terrain features on an 8 foot diameter turntable in the wind tunnel.

(3) Testing of the model in the wind tunnel in a properly simulated Earth's boundary layer (i.e., in a flow field with the appropriate gustiness and increase in velocity with height). Such testing is usually performed both with and without the new buildings in place to allow an evaluation of the effect of the new building. In your case, we may want to modify the procedure since you apparently already have a wind problem. I will discuss this further below.

(4) The results of the study of the weather and the wind tunnel test are then assembled so as to predict what wind speed will be exceeded (say 2% of the time) at each measuring station. The results of this study can be compared with suggested criteria

to determine whether or not the wind exceeded 2% of the time at a given station is or is not excessive. The output of the computer program which performs the analysis not only indicates if a station is too windy but also what wind direction or directions are most responsible for the windy condition. The latter is a very important consideration because it is frequently possible to use landscaping, etc., to alleviate windy areas. However, one must know the wind direction which induces the problem so as to make most effective use of barriers, trees, etc.

I am enclosing our facility brochure and two papers I have written on this subject which illustrate the methods and techniques outlined above. I have also included a recent study of a building in Boston.

As Professor Baron suggested, I believe a trip to the University of Minnesota would be useful as I am not directly familiar with the campus or your current problem.

Qualitatively, we know the methods used here at WBWT work; however, there is little or no data to confirm how accurate they are quantitatively. As a result, I have had underway for about two years a study to develop a simple reliable package to obtain on-site ground wind data. Currently, a Master's candidate is completing the prototype package and the necessary programming, etc. to use the system. As a possible adjunct to the wind tunnel program, I would like to suggest that we bring his prototype device out to the University of Minnesota. I could show either a student or some other person how to use it so that actual on-site data could be obtained and later compared with some of the wind tunnel results. The above is contingent on your having some way of measuring the basic wind (i.e., an anemometer measurement of wind at the top of a campus tower or tall building). I can discuss this with you in more detail whever we next talk.

Since you already have a wind problem, I would suggest that, as part of the overall plan, both a representative of the University of Minnesota and the associated architects plan to come to Boston about a week after completion of the first wind tunnel tests so as to both suggest modifications to reduce windiness and further to witness the wind tunnel test of the then proposed solutions.

Finally, let me give you a rough idea of the timing and costs. Obtaining and analyzing the weather data typically takes 4-6 weeks of which 2 to 4 weeks are spent ordering and waiting for the weather data from the National Climatic Center at Asheville, North Carolina. The cost of the wind analysis will be about $5,000.+

Designing and building the model also takes about 6 weeks and costs about $7,000. If a wooden model of an appropriate scale already exists then this

cost would be reduced. Clearly, the model construction and weather analysis will be carried out in parallel.

The first wind tunnel test should occur about six weeks after the start of the program and will take about 2 weeks to complete. Results should be available the following week. The cost of this test is somewhat dependent on the number of stations used, but should be between $9,000 and $12,000.

The second test period (of possible solutions) if it follows within two weeks should last about 1 week and cost an additional $5,000.

If you should want to have some on-site data taken the cost would be about $5,000. Note that to insure that my thesis candidate is able to finish his thesis during this Fall semester, we would build a second prototype instrument for your study. The prototype would take about 4-6 weeks to build largely due to delays in obtaining parts. The new prototype could be ready by about November 1st thus enabling data to be taken for windy days during November and December. Note that we do not expect to obtain sufficient data from these tests to make any over all evaluation of on-site winds; rather the purpose is simply to confirm the wind tunnel results for one or two stations and wind directions.

The major testing and tests of the fixes should be completed on or about the middle of December although a report will take an additional couple of months. Report costs will be about $4,000.

Summing up, the total program will cost about $40,000. We should be able to have results for the current situation as well as with the new building by about December 1st and to evaluate any proposed changes by mid-December. (The latter will require close operation between you and the architects as well as some preplanning in regard to possible methods of reducing the winds at critical stations.) The final report would be completed about mid-February. All the above assumes an October 1st start if that should prove feasible.

If you have questions of any kind please call.

Yours very truly,

Frank H. Durgin

Frank H. Durgin
Associate Director
Wright Brothers Wind Tunnel

FHD:mb
Enclosures

cc: J.R. Baron
E.A. Witmer
File

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

November 5, 1980

Mr. Frank H. Durgin
Wright Brothers Wind Tunnel
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Mr. Durgin:

After reviewing your proposal for conducting a ground wind study for a portion of the University of Minnesota Twin Cities Campus, we have selected your firm to perform this study.

Mr. Paul Maupin will be the University coordinator for this study and will serve as your contact person. Mr. Maupin's address is: Health Sciences Planning Office. Physical Planning, 4103 Powell Hall, Box 75, 500 Essex Street S.E., Minneapolis, Minnesota 55455. His telephone number is: (612) 373-8981. You are hereby authorized to make the necessary arrangements with Mr. Maupin for your initial visit to our campus in connection with this study. The University will reimburse you for your travel expenses in connection with this visit. We are anxious to proceed with the study and ask that you be prepared to finalize our contractural agreement the day of your initial visit. We look forward to working with you.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH:jr

cc: Robert Dickler
Paul Maupin
Gary Summerville

I. INTRODUCTION

This proposal discusses a suggested wind tunnel study of pedestrian level winds in the Health Science area of the Minneapolis campus of the University of Minnesota. Some on-site measurements are also proposed. The study will take approximately six months to complete and will cost $41,196 . Of this total, $4,970 is the portion estimated for the on-site measurements. Data suitable for design decisions will be available at the end of the fourth month of the study period.

Wind tunnel studies of such pedestrian level winds involve four major parts:

1. A study of general wind conditions for the Minneapolis campus site.

2. Construction of a model of the Campus to an appropriate scale.

3. The actual measurement of pedestrian level winds at those stations selected to be of interest on the model.

4. A combination of the results from (1) and (3) so as to predict how often a given wind is exceeded, etc., and allow comparison of the results with various criteria.

In this study it will be necessary to carry out steps (3) and (4) both for the campus as is, as well as with the proposed new hospital in place, in order to evaluate the effect introduced by the new building. Once the results of the first two tests are known, (3) and (4) will be repeated once again for any proposed changes that are indicated to alleviate the windiness at any stations deemed to be too windy from the first two tests.

The proposed on-site testing will be used as a check on the quantitative validity of the wind tunnel results.

A final report covering all aspects of the work will be provided to the University of Minnesota at the end of the program.

Each of the above facets of the program is discussed in the following section. The schedule and estimated costs are given in sections VIII and IX.

II. ANALYSIS OF THE REGIONAL WINDS

In order to interpret wind tunnel results when simulating ground winds, those results must be combined with estimates of how often the wind at gradient height (about 1700 ft altitude) will blow from each direction for any given wind speed. The required regional wind rose data makes necessary an analysis of weather records from the Minneapolis-St. Paul airport as well as several other cities within a 200 mile radius. Such records will be obtained from the National Climatic Center in Asheville, North Carolina.

The Wright Brothers Wind Tunnel has been involved in several previous studies for buildings in the cities of Chicago, Ill., South Bend and Indianapolis, Ind. and Toledo and Cincinnati, Ohio. Thus data for these and other "nearby" cities is already in-house. Further, a regional wind rose for the Ohio-Indiana-Illinois region has been developed. For the proposed study it is planned to obtain data for Minneapolis, St. Paul, Duluth, and at least two other nearby cities. The data will be used to develop wind rose data which will be of a regional nature for Minnesota.

Note that we have found at the Wright Brothers Wind Tunnel that the data from any one city will sometimes be in error. The use of several cities to obtain a regional type wind rose increases both the reliability of the final wind rose that is obtained and also makes the wind rose obtained applicable over a region. While it is expected that most weather data will be available by the end of six weeks, any additional data found after that time will also be included in the final analysis.

III. MODELS

It will be necessary to construct a model of the Minneapolis campus of the University of Minnesota. The model will be approximately 8 ft in diameter and centered in the Health Sciences area. Construction details will be such that tests can be run both with and without the new hospital present, as well as allowing for planned methods of reducing high winds. The model will be entirely of wood or a similar material and will take approximately six weeks to plan and build. The scale will be between 1-300 and 1-600. The actual choice of scale will be based on wind tunnel blockage considerations and how much of the campus needs to be included in the model.

IV. THE WIND TUNNEL TESTS

The wind tunnel tests will be performed in the Wright Brothers Wind Tunnel. There will be four different tests:

1. A test to verify that the simulated earth's boundary layer that is being used is in fact appropriate. It is planned to use a suburban-type boundary layer, i.e. one where the velocity varies with height as $V/V_g = (h/h_g)^{\alpha}$, where $\alpha \simeq 0.25\text{-}0.28$ and h_g is about 1300 ft.

2. A test in which velocities are measured at each of up to 35 stations, as will be agreed upon between the representatives of the University of Minnesota and the MIT WBWT. For these tests measurements will be made of the average, the root mean square variation about the average and the peak wind velocities at each station for each of the 16 compass directions. Data at each station and direction will be monitored for roughly the equivalent of one hour full scale. For this test the campus will be configured as it is today.

3. A third test in which velocities will be measured at all stations will then be performed with the new hospital in place. With the possible exception of a few stations these will be the same as those in the first test.

4. After completion of the second and third tests, the results will be combined with weather information (section V below). The results will be sent to all concerned parties. Two weeks after that distribution a meeting will be called at MIT for discussion of any problem areas. It will be essential that those in attendance be in a position to make design decisions.

Possible ways of alleviating windy stations will then be examined using flow visualization while all parties are present. The flow visualization will be used to decide which of several techniques is best in terms of all possible interacting requirements (it is realized that wind is only one of many factors which contribute to the most acceptable wind alleviation technique).

Finally, having picked the optimum alleviation technique for each wind station, velocities then will be measured again at each of the affected stations.

V. COMBINING THE WIND TUNNEL RESULTS WITH THE WIND ROSE

The wind tunnel results described in section IV and the wind rose results discussed in section II are to be combined in order to predict the wind that is exceeded 2% of the time at each station. The procedure used to make the prediction also includes an estimate of how much of the total two percent is contributed by each wind direction. Thus the data also provides the wind direction(s) contributing in a major sense to the probability i.e. the critical wind directions. This latter information is of some importance in the planning of kinds of alleviation methods that might be suitable when a station is found to be too windy.

The relative windiness at each station will be determined by comparing the calculated 2% exceedance wind with that from an international criteria developed by Melbourne and used frequently at the Wright Brothers Wind Tunnel[1]. A few stations will also be chosen to exemplify areas that are currently satisfactory. These will be used to check the validity of the international criteria. Due to the fact that people become accustomed to local wind conditions that may differ significantly from the average throughout the world, such checks are quite necessary.

VI. ON-SITE STUDY

Qualitatively, there is confidence in the methods as used at the Wright Brothers Wind Tunnel; however, there is relatively little data to confirm how accurate the methods are quantitatively. As a result we have had underway for about two years a study devoted to developing a simple yet reliable package with the capability of obtaining on-site ground wind data. Currently a Master's degree candidate is completing a prototype

package and the necessary programming, etc., to use the system. His thesis is scheduled to be completed by January 15, 1981.

It is proposed to have the graduate student bring his device to the University of Minnesota and show the appropriate people how they might use it. Data could then be obtained at several stations on windy days throughout the winter. The data is recorded on ordinary cassette type magnetic tape and could be sent back to MIT for reduction and comparison with wind tunnel results. We would also plan to build a second prototype for use late in the program to enable additional data to be obtained.

It would be highly desirable that there be an existing anemometer on campus which could be monitored at the same time as data is being taken. Otherwise airport data will be used.

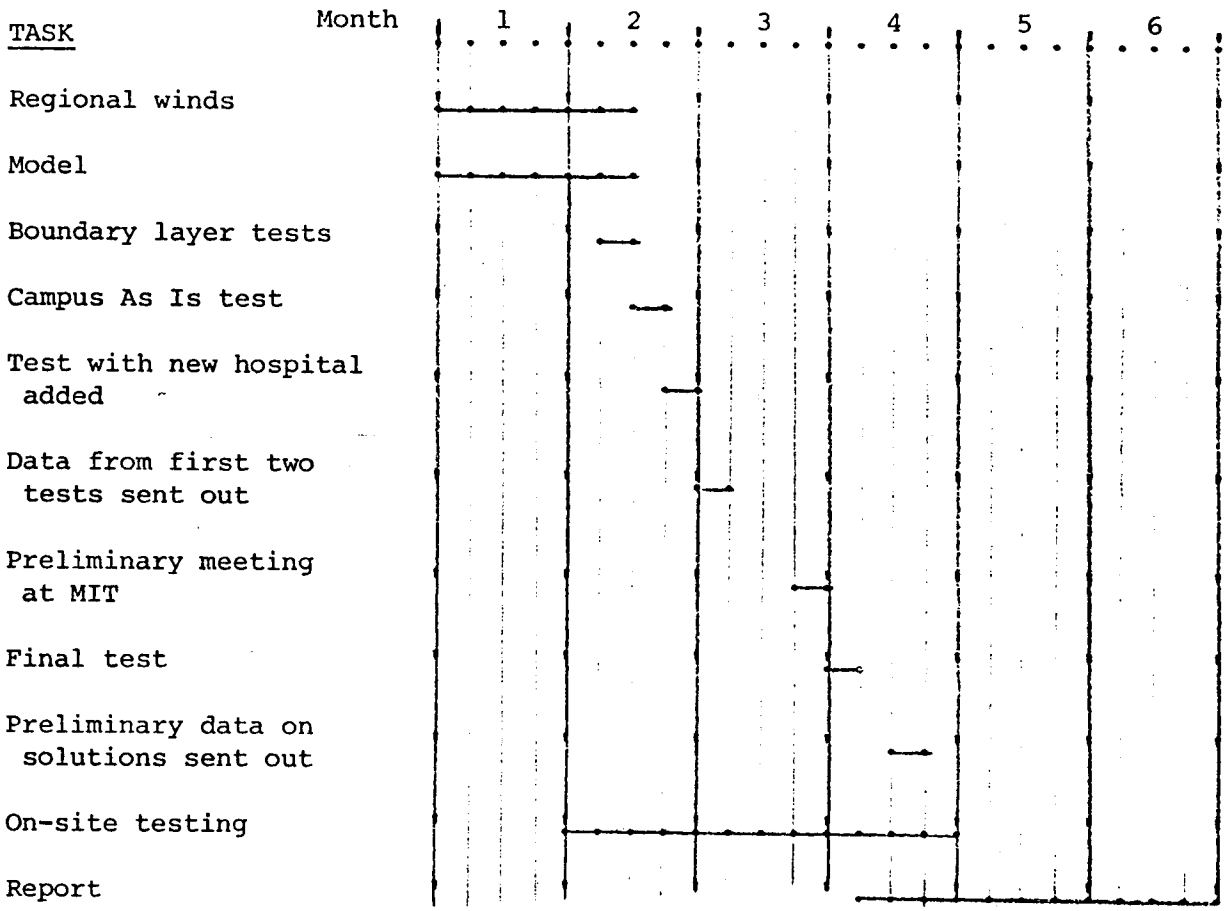
Since the on-site study is not absolutely essential to the rest of the program, its cost is listed separately in the cost estimate.

VII. REPORTS

A report covering all aspects of the work will be issued at the end of the program. As noted above, preliminary estimates of the 2% winds both with and without the new hospital will be available at the end of 9 weeks. First preliminary results evaluating the proposed wind alleviation solutions will be available two weeks following the meeting at MIT in which the decision on alleviation methods to be tested is made.

VIII. SCHEDULING

Note: The schedule is firm until the meeting at MIT. The remainder of the schedule depends on decisions made at that meeting.



IX. ESTIMATED COST

			Main		On-Site	
Salaries and Wages						
Baron	.3	1220.		.05	203.	
Durgin	2.25	6640.		.25	738.	
Earl	1.5	2432.				
Secretary	.25	302.				
			10,594.			941.
Employee Benefits			2,860			254.
Research Assistant	4 mm		4,796.	1.5		1799.
Operating Expenses						
Wind tunnel	60 hrs @ 75.	4500.				
Wood & Misc supplies		500.				
Report		500.				
Part for new on-site device		300.			500.	
Travel		1000.				
			6,800.			500.
Total Direct Cost			25,050.			3,494.
Indirect Costs			11,176.			1,476.
			36,226.			4,970.
				41,196.		

Ellerbe Associates, Inc.
Hellmuth, Obata & Kassabaum, Inc.
An Association

100 University Ave. SE
Suite 100
Minneapolis, MN 55414
612 378 3300

November 25, 1980

Mr. Paul Maupin
Coordinator, Health Services
5105 Powell Hall
500 Essex Street S. E.
Minneapolis, MN 55455

Dear Paul:

Ellerbe/HOK has reviewed the advance copy of a wind study proposal from M.I.T. Wright Brothers Memorial Wind Tunnel. We offer the following comments:

1. Whenever preliminary or final analysis results or recommendations are provided to the U of M by the consultant, we should be copied.

2. The study should include analysis and recommendations for solutions to the existing Unit K/E, Diehl Hall (and any other potential source in the vicinity) problem of toxic or hazardous exhausts being emitted to the atmosphere. We are interested in the degree of problem as it now exists, the effect the new hospital building will have on existing conditions and the difficulties we can expect during the construction period and final occupancy of Unit "J".

3. Unit "J" mass has been set and the design is proceeding at a rapid pace. The proposed time schedule of the wind study will provide major design decisions by approximately April 1, 1981. Modifications to Unit "J" to accommmodate wind study decisions will become increasingly difficult to implement as the building develops.

Yours truly,

William A. Murray

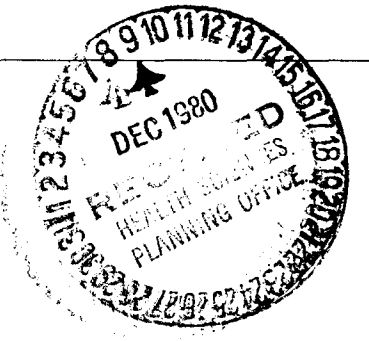
William A. Murray, P.E.

WAM b

cc: Ron Cannamore
Don Berry
Bob Dickler
Clint Hewitt

Ellerbe Associates, Inc.
Hellmuth, Obata & Kassabaum, Inc.
An Association

100 University Ave. SE
Suite 100
Minneapolis, MN 55414
612 378 3300



December 8, 1980

Mr. Paul Maupin
Coordinator, Health Sciences
4105 Powell Hall
500 Essex Street S. E.
Minneapolis, MN 55455

Dear Paul

Data requested by Mr. Frank Durgin was transmitted to you this date. The transmittal included:

1. City of Minneapolis Topo Plans 63-B and 63-D. These plans are dated 1956 so are quite obsolete.

2. Six (6) aerial view slides of the Health Center complex which were obtained from the Bio Medical Graphics Department.

3. Seventeen (17) slides of various locations in the Health Center complex which I photographed.

4. One of Ellerbe/HOK site plans of the campus orienting the locations at which the slides were taken.

I would appreciate the return of the seventeen (17) slides that I took, if possible. Ellerbe/HOK have a number of colored slides which may be helpful to Mr. Durgin in conducting the Wind Study if additional information is required.

Yours truly,

William A. Murray

William A. Murray, P.E.

WAM b

cc: Ron Cannamore

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
4103 Powell Hall, Box 75
500 Essex Street S.E.
Minneapolis, Minnesota 55455
(612) 373-8981

December 23, 1980

TO: Clint Hewitt

FROM: Paul J. Maupin

SUBJECT: Wind Study

On Friday, December 19, 1980, I received a call from Mr. Frank Durgin of MIT. Frank has informed me that MIT will not permit him to start work or make any expenditures without a signed contract from the University of Minnesota.

Obviously, this puts this project behind. Anything you can do to expediate getting a signed contract to Mr. Durgin will be appreciated.

We will of course want a copy of the contract for our files.

PJM:jm

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

December 30, 1980

TO: Paul Maupin

FROM: Clint Hewitt

In response to your memorandum of December 23, 1980 regarding the information you received from Mr. Frank Durgin that MIT would not allow him to begin work on the Wind Study Project until a signed contract had been achieved with the University, I have asked Gary to try to get the contract in the mail to MIT early this week. I believe he has had some conversation with the staff at MIT to clarify the type of contract they would sign. I have asked Gary to send a copy of the proposed contract to you.

CNH/kh

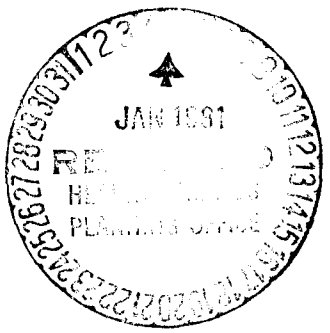
cc: Gary Summerville

Wind Study

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455



December 31, 1980

Massachusetts Institute of Technology
Office of Sponsored Programs
77 Massachusetts Avenue
Room E19-702
Cambridge, Massachusetts 02139

Attn: Ms. Patricia K. Greer

Dear Sirs:

This letter is your authority to proceed with the Pedestrian Level Wind Study for the University of Minnesota. Throughout this letter the University of Minnesota shall be referred to as "the Sponsor" and the Massachusetts Institute of Technology shall be referred to as "the Institute". The research program contemplated by this agreement is of mutual interest and benefit to the Institute and to the Sponsor, and will further the instructional and research objectives of the Institute in a manner consistent with its status as a non-profit, tax exempt, educational institution.

Now, therefore, the parties hereto agree as follows:

1. STATEMENT OF WORK. The Institute agrees to use its best efforts to perform the research program entitled Proposal to Perform Pedestrian Level Wind Study for the University of Minnesota dated November 20, 1980 as described in Exhibit A, attached hereto.

2. PRINCIPAL INVESTIGATOR. The research will be supervised by Professor Judson R. Baron and Mr. Frank H. Durgin. If, for any reason they are unable to continue to serve as Principal Investigators, and successors acceptable to both the Institute and the Sponsor are not available, this agreement shall be terminated as provided in Article 6.

3. PERIOD OF PERFORMANCE. The research shall be conducted during a six month period beginning January 2, 1981 and will be subject to renewal only by mutual agreement of the parties.

   Within 60 days of completing this agreement the Institute will furnish the Sponsor a progress report describing the amount of work completed to date, the percent of total project effort completed to date and the amount of reimbursement billed and earned to date.

4. REIMBURSEMENT OF COSTS. In consideration of the foregoing, the Sponsor will reimburse the Institute for all direct and indirect costs incurred in the performance of the research which shall not exceed the total estimated project cost of $41,196.00 without written authorization from the Sponsor. Payments to the Institute shall be made on the basis of monthly billings submitted by the Institute. Such billings shall be written, shall include a reasonable explanation for the amount of the billing, shall include the sponsors purchase order number, and shall be signed by the authorized official of the Institute. Billing to the Sponsor may be made in advance.

   A final financial accounting of all costs incurred and all funds received by the Institute hereunder together with a check for the amount of the unexpended balance, if any, shall be submitted to the Sponsor within ninety days following the completion of the project.

5. TERMINATION. Performance under this agreement may be terminated by the Sponsor upon thirty days written notice; performance may be terminated by the Institute if circumstances beyond its control preclude continuation of the research. Upon termination, the Institute will be reimbursed as specified in Article 4 for all costs and non-cancellable commitments incurred in the performance of the research, such reimbursement not to exceed the total estimated project cost specified in Article 4.

6. PUBLICATIONS AND COPYRIGHTS. The Institute will be free to publish the results of research under this agreement, after providing a copy of the publication to the Sponsor. Title to and the right to determine the disposition of any copyrights, or copyrightable material, first produced or composed in the performance of this research shall remain with the Institute. Such disposition shall take into account the public interest as well as the rights and equities of the Institute and the Sponsor.

7. PATENTS. Title to any invention conceived or reduced to practice in the performance of this research will remain with the Institute, which shall have the sole right to determine disposition of any patents or other rights resulting therefrom. Such disposition shall take into account the public interest as well as the rights and equities of the Institute and the Sponsor.

8. USE OF THE INSTITUTE'S NAME. The Sponsor agrees not to use the name of the Institute or any member of its staff in sales promotion work or advertising or in any other forms of publicity without the written approval of the Director of the News Office.

9. SUCCESSORS AND ASSIGNMENTS. This agreement shall be binding upon and inure to the benefit of the Sponsor and the Institute and their respective successors and assigns. The Institute shall not assign any interest under this agreement without the written consent of the Sponsor.

10. NON-DISCRIMINATION IN EMPLOYMENT. The Institute agrees not to discriminate against any employee or applicant for employment to be employed by the Institute in the performance of this agreement with respect to hire, tenure, terms, conditions, or privileges of employment, or any matter directly or indirectly related to employment because of race, color, religion, sex, national origin, or ancestry.

11. Since the Institute is an educational institution, it will act only to generate state-of-the-act data, but not to interpret the data and make decisions. The Institute and its employees do not in any way guarantee that predicted results can or will materialize.

If this letter agreement meets with your approval, please sign three copies and return them to this office.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH:GJS:jr

cc: Paul Maupin
George H. Dummer
Professor Judson R. Baron

APPROVED:

Massachusetts Institute of Technology

By _____

Title _____

Date _____

I. INTRODUCTION

This proposal discusses a suggested wind tunnel study of pedestrian level winds in the Health Science area of the Minneapolis campus of the University of Minnesota. Some on-site measurements are also proposed. The study will take approximately six months to complete and will cost $41,196. Of this total, $5,470 is the portion estimated for the on-site measurements. Data suitable for design decisions will be available at the end of the fourth month of the study period. All testing will be done at the Wright Brothers Wind Tunnel of the Massachusetts Institute of Technology (WBWT-MIT).

Wind tunnel studies of such pedestrian level winds involve four major parts:

1. A study of general wind conditions for the Minneapolis campus site.

2. Construction of a model of the Campus to an appropriate scale.

3. The actual measurement of pedestrian level winds at those stations selected to be of interest on the model.

4. A combination of the results from (1) and (3) so as to predict how often a given wind is exceeded, etc., and allow comparison of the results with various criteria.

In this study it will be necessary to carry out steps (3) and (4) both for the campus as is, as well as with the proposed new hospital in place, in order to evaluate the effect introduced by the new building. Once the results of the first two tests are known, (3) and (4) will be repeated once again for any proposed changes that are indicated to alleviate the windiness at any stations deemed to be too windy from the first two tests.

The proposed on-site testing will be used as a check on the quantitative validity of the wind tunnel results.

A final report covering all aspects of the work will be provided to the University of Minnesota at the end of the program.

Each of the above facets of the program is discussed in the following section. The schedule and estimated costs are given in sections VIII and IX.

II. ANALYSIS OF THE REGIONAL WINDS

In order to interpret wind tunnel results when simulating ground winds, those results must be combined with estimates of how often the wind at gradient height (about 1700 ft altitude) will blow from each direction for any given wind speed. The required regional wind rose data makes necessary an analysis of weather records from the Minneapolis-St. Paul airport as well as several other cities within a 200 mile radius. Such records will be obtained from the National Climatic Center in Asheville, North Carolina.

The Wright Brothers Wind Tunnel has been involved in several previous studies for buildings in the cities of Chicago, Ill., South Bend and Indianapolis, Ind. and Toledo and Cincinnati, Ohio. Thus data for these and other "nearby" cities is already in-house. Further, a regional wind rose for the Ohio-Indiana-Illinois region has been developed. For the proposed study it is planned to obtain data for Minneapolis/St. Paul, Duluth, and at least two other nearby cities. The data will be used to develop wind rose data which will be of a regional nature for Minnesota.

Note that we have found at the Wright Brothers Wind Tunnel that the data from any one city will sometimes be in error. The use of several cities to obtain a regional type wind rose increases both the reliability of the final wind rose that is obtained and also makes the wind rose obtained applicable over a region. While it is expected that most weather data will be available by the end of six weeks, any additional data found after that time will also be included in the final analysis.

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The wind tunnel tests will be performed in the Wright Brothers Wind Tunnel. There will be four different tests:

1. A test to verify that the simulated earth's boundary layer that is being used is in fact appropriate. It is planned to use a suburban-type boundary layer, i.e. one where the velocity varies with height as $V/V_g = (h/h_g)^{\alpha}$, where $\alpha \simeq 0.25\text{-}0.28$ and h_g is about 1300 ft.

2. A test in which velocities are measured at each of up to 35 stations, as will be agreed upon between the representatives of the University of Minnesota and the MIT WBWT. For these tests measurements will be made of the average, the root mean square variation about the average and the peak wind velocities at each station for each of the 16 compass directions. Data at each station and direction will be monitored for roughly the equivalent of one hour full scale. For this test the campus will be configured as it is today.

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Finally, having picked the optimum alleviation technique for each wind station, velocities then will be measured again at each of the affected stations.

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The relative windiness at each station will be determined by comparing the calculated "2% exceedance wind" with that from an international criteria developed by Melbourne and used frequently at the Wright Brothers Wind Tunnel[1]. A few stations will also be chosen to exemplify areas that are currently satisfactory. These will be used to check the validity of the international criteria. Due to the fact that people become accustomed to local wind conditions that may differ significantly from the average throughout the world, such checks are necessary.

VI. ON-SITE STUDY

Qualitatively, there is confidence in the methods as used at the Wright Brothers Wind Tunnel; however, there is relatively little data to confirm how accurate the methods are quantitatively. As a result we have had underway for about two years a study devoted to developing a simple yet reliable package with the capability of obtaining on-site ground wind data. Currently a Master's degree candidate is completing a prototype

package and the necessary programming, etc., to use the system. His thesis is scheduled to be completed by January 15, 1981.

It is proposed to have the graduate student bring his device to the University of Minnesota and show the appropriate people how they might use it. Data could then be obtained at several stations on windy days throughout the winter. The data is recorded on ordinary cassette type magnetic tape and could be sent back to MIT for reduction and comparison with wind tunnel results. We would also plan to build a second prototype for use late in the program to enable additional data to be obtained.

It would be highly desirable that there be an existing anemometer on campus which could be monitored at the same time as the on-site data is being taken. Otherwise airport data will be used.

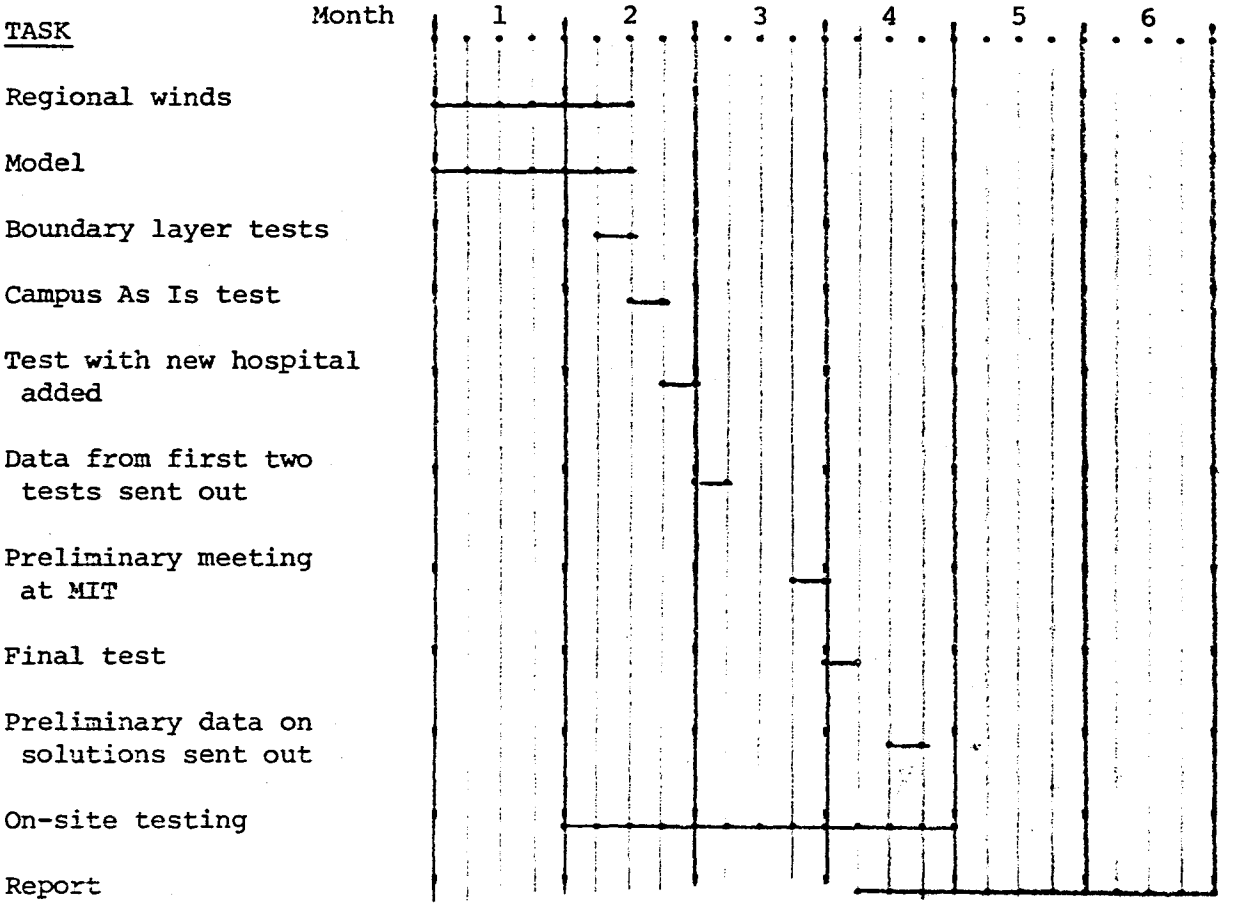
Since the on-site study is not absolutely essential to the rest of the program, its cost is listed separately in the cost estimate.

VII. REPORTS

A report covering all aspects of the work will be issued at the end of the program. As noted above, preliminary estimates of the "2% exceedance winds" both with and without the new hospital will be available at the end of 9 weeks. First preliminary results evaluating the proposed wind alleviation solutions will be available two weeks following the meeting at MIT in which the decision on alleviation methods to be tested is made.

VIII. SCHEDULING

Note: The schedule is firm until the meeting at MIT. The remainder of the schedule depends on decisions made at that meeting.



IX. ESTIMATED COST

			Main		On-Site	
Salaries and Wages						
Baron	.3	1220.		.05	203.	
Durgin	2.25	6640.		.25	738.	
Earl	1.5	2432.				
Secretary	.25	302.				
			10,594.			941.
Employee Benefits			2,860			254.
Research Assistant	4 mm		4,796.	1.5		1799.
Operating Expenses						
Wind tunnel	60 hrs @ 75.	4500.				
Wood & Misc supplies		500.				
Report		500.				
Part for new on-site device		300.			500.	
Travel		500.			500.	
			6,300.			1000.
Total Direct Cost			24,550.			3994.
Indirect Costs			11,176.			1,476.
			35,726.			5,470.
				41,196.		

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

January 20, 1981

TO: Paul Maupin

FROM: Clint Hewitt

Attached for your reference is a copy of the agreement we have with the Massachusetts Institute of Technology regarding the Wind Study to be performed for the Health Sciences areas of the Minneapolis Campus. Now that the agreement has been executed, I want this project to become one of your top priority projects and to proceed "full steam" ahead.

This project is charged to the Hospital Renewal Project account, but as suggested by Mr. Dickler, it would not be inappropriate for other Health Sciences projects in the area to fund a portion of the cost. I request recommendations from you regarding other Health Science project funding for this Wind Study.

CNH/pj

Enclosure
cc: Robert Dickler
Dave Kerkow
Vic Scott
Central Files

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

December 31, 1980

Massachusetts Institute of Technology
Office of Sponsored Programs
77 Massachusetts Avenue
Room E19-702
Cambridge, Massachusetts 02139

Attn: Ms. Patricia K. Greer

Dear Sirs:

This letter is your authority to proceed with the Pedestrian Level Wind Study for the University of Minnesota. Throughout this letter the University of Minnesota shall be referred to as "the Sponsor" and the Massachusetts Institute of Technology shall be referred to as "the Institute". The research program contemplated by this agreement is of mutual interest and benefit to the Institute and to the Sponsor, and will further the instructional and research objectives of the Institute in a manner consistent with its status as a non-profit, tax exempt, educational institution.

Now, therefore, the parties hereto agree as follows:

1. STATEMENT OF WORK. The Institute agrees to use its best efforts to perform the research program entitled Proposal to Perform Pedestrian Level Wind Study for the University of Minnesota dated November 20, 1980 as described in Exhibit A, attached hereto.

2. PRINCIPAL INVESTIGATOR. The research will be supervised by Professor Judson R. Baron and Mr. Frank H. Durgin. If, for any reason they are unable to continue to serve as Principal Investigators, and successors acceptable to both the Institute and the Sponsor are not available, this agreement shall be terminated as provided in Article 6.

3. PERIOD OF PERFORMANCE. The research shall be conducted during a six month period beginning January 2, 1981 and will be subject to renewal only by mutual agreement of the parties.

   Within 60 days of completing this agreement the Institute will furnish the Sponsor a progress report describing the amount of work completed to date, the percent of total project effort completed to date and the amount of reimbursement billed and earned to date.

4. REIMBURSEMENT OF COSTS. In consideration of the foregoing, the Sponsor will reimburse the Institute for all direct and indirect costs incurred in the performance of the research which shall not exceed the total estimated project cost of $41,196.00 without written authorization from the Sponsor. Payments to the Institute shall be made on the basis of monthly billings submitted by the Institute. Such billings shall be written, shall include a reasonable explanation for the amount of the billing, shall include the sponsors purchase order number, and shall be signed by the authorized official of the Institute. Billing to the Sponsor may be made in advance.

   A final financial accounting of all costs incurred and all funds received by the Institute hereunder together with a check for the amount of the unexpended balance, if any, shall be submitted to the Sponsor within ninety days following the completion of the project.

5. TERMINATION. Performance under this agreement may be terminated by the Sponsor upon thirty days written notice; performance may be terminated by the Institute if circumstances beyond its control preclude continuation of the research. Upon termination, the Institute will be reimbursed as specified in Article 4 for all costs and non-cancellable commitments incurred in the performance of the research, such reimbursement not to exceed the total estimated project cost specified in Article 4.

6. PUBLICATIONS AND COPYRIGHTS. The Institute will be free to publish the results of research under this agreement, after providing a copy of the publication to the Sponsor. Title to and the right to determine the disposition of any copyrights, or copyrightable material, first produced or composed in the performance of this research shall remain with the Institute. Such disposition shall take into account the public interest as well as the rights and equities of the Institute and the Sponsor.

7. PATENTS. Title to any invention conceived or reduced to practice in the performance of this research will remain with the Institute, which shall have the sole right to determine disposition of any patents or other rights resulting therefrom. Such disposition shall take into account the public interest as well as the rights and equities of the Institute and the Sponsor.

8. USE OF THE INSTITUTE'S NAME. The Sponsor agrees not to use the name of the Institute or any member of its staff in sales promotion work or advertising or in any other forms of publicity without the written approval of the Director of the News Office.

9. SUCCESSORS AND ASSIGNMENTS. This agreement shall be binding upon and inure to the benefit of the Sponsor and the Institute and their respective successors and assigns. The Institute shall not assign any interest under this agreement without the written consent of the Sponsor.

10. NON-DISCRIMINATION IN EMPLOYMENT. The Institute agrees not to discriminate against any employee or applicant for employment to be employed by the Institute in the performance of this agreement with respect to hire, tenure, terms, conditions, or privileges of employment, or any matter directly or indirectly related to employment because of race, color, religion, sex, national origin, or ancestry.

11. Since the Institute is an educational institution, it will act only to generate state-of-the-act data, but not to interpret the data and make decisions. The Institute and its employees do not in any way guarantee that predicted results can or will materialize.

If this letter agreement meets with your approval, please sign three copies and return them to this office.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH:GJS:jr

cc: Paul Maupin
George H. Dummer
Professor Judson R. Baron

APPROVED:

Massachusetts Institute of Technology

By _____

Title George H. Dummer, Director
Office of Sponsored Program

Date 1/14/81

APPROVED

Proposal to Perform

A Pedestrian Level Wind Study

for the University of Minnesota

to

University of Minnesota
Physical Planning
340 Morrill Hall
100 Church St. S.E.
Minneapolis, Minnesota 55455

Attn: Mr. Paul Maupin

November 20, 1980

from

The Wright Brothers Memorial Wind Tunnel
Department of Aeronautics and Astronautics
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

I. INTRODUCTION

This proposal discusses a suggested wind tunnel study of pedestrian level winds in the Health Science area of the Minneapolis campus of the University of Minnesota. Some on-site measurements are also proposed. The study will take approximately six months to complete and will cost $41,196. Of this total, $5,470 is the portion estimated for the on-site measurements. Data suitable for design decisions will be available at the end of the fourth month of the study period. All testing will be done at the Wright Brothers Wind Tunnel of the Massachusetts Institute of Technology (WBWT-MIT).

Wind tunnel studies of such pedestrian level winds involve four major parts:

1. A study of general wind conditions for the Minneapolis campus site.

2. Construction of a model of the Campus to an appropriate scale.

3. The actual measurement of pedestrian level winds at those stations selected to be of interest on the model.

4. A combination of the results from (1) and (3) so as to predict how often a given wind is exceeded, etc., and allow comparison of the results with various criteria.

In this study it will be necessary to carry out steps (3) and (4) both for the campus as is, as well as with the proposed new hospital in place, in order to evaluate the effect introduced by the new building. Once the results of the first two tests are known, (3) and (4) will be repeated once again for any proposed changes that are indicated to alleviate the windiness at any stations deemed to be too windy from the first two tests.

The proposed on-site testing will be used as a check on the quantitative validity of the wind tunnel results.

A final report covering all aspects of the work will be provided to the University of Minnesota at the end of the program.

Each of the above facets of the program is discussed in the following section. The schedule and estimated costs are given in sections VIII and IX.

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In order to interpret wind tunnel results when simulating ground winds, those results must be combined with estimates of how often the wind at gradient height (about 1700 ft altitude) will blow from each direction for any given wind speed. The required regional wind rose data makes necessary an analysis of weather records from the Minneapolis-St. Paul airport as well as several other cities within a 200 mile radius. Such records will be obtained from the National Climatic Center in Asheville, North Carolina.

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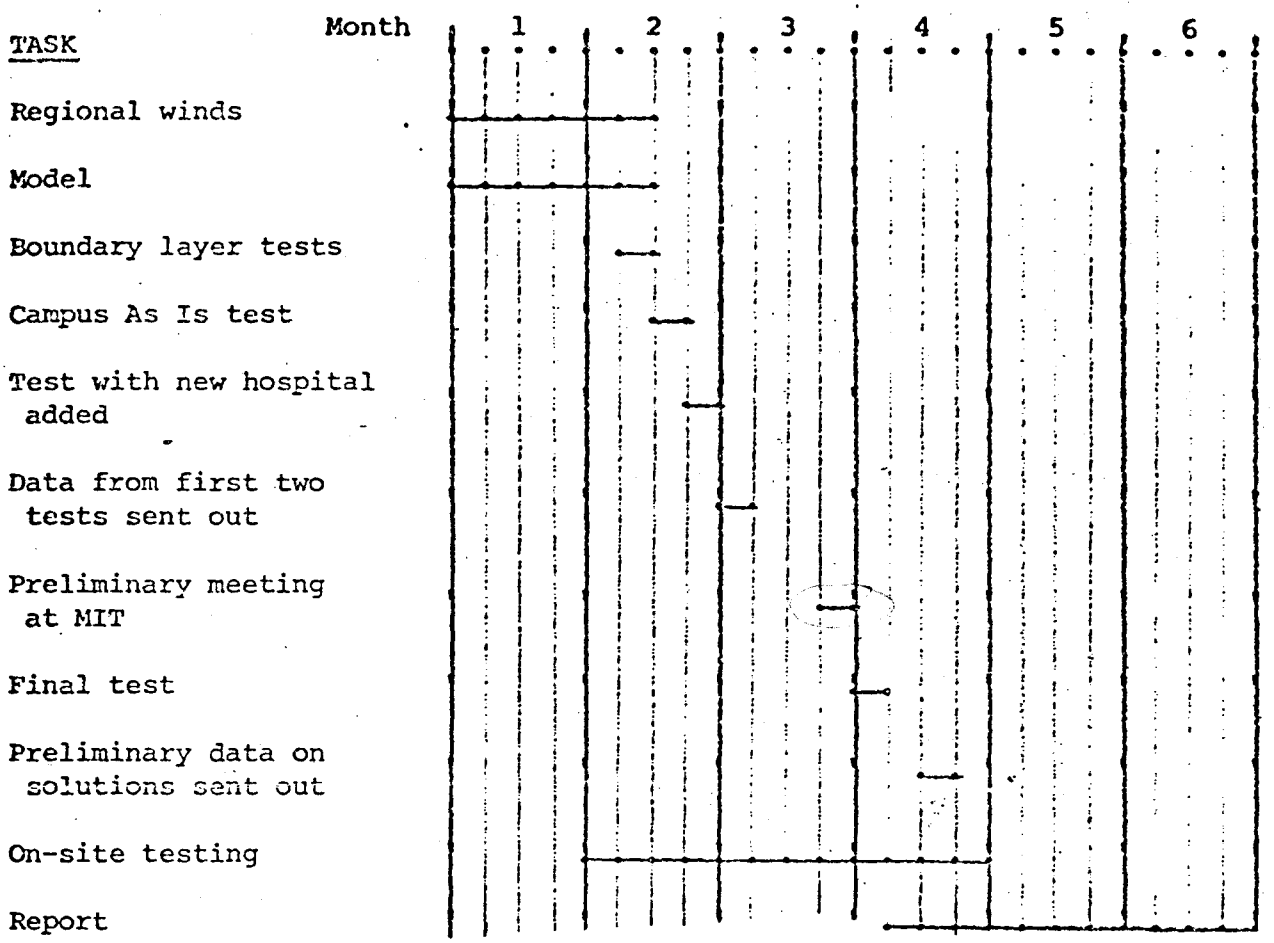

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UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
4103 Powell Hall, Box 75
500 Essex Street S.E.
Minneapolis, Minnesota 55455
(612) 373-8981

February 3, 1981

Mr. Frank Durgin
Wright Brothers Wind Tunnel
Building 17-110
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Frank:

Now that the contract for the Wind Study has been executed, we assume that you are proceeding accordingly. In the event that MIT functions as the University of Minnesota, we have enclosed a copy of the contract for your reference.

I would appreciate it if you would refer to the schedule on page 7 of the proposal and plug in the current schedule dates for our information.

Very truly yours,

Paul J. Maupin
Health Sciences Planning Coordinator

PJM:jm

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
4103 Powell Hall, Box 75
500 Essex Street S.E.
Minneapolis, Minnesota 55455
(612) 373-8981

February 3, 1981

TO: Clint Hewitt

FROM: Paul J. Maupin

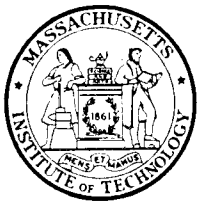
SUBJECT: Wind Study Funding

We understand Mr. Dickler's position that it may not be inappropriate for other projects in the Health Sciences to fund a portion of the Wind Study. However, as you are aware, all the funds on the current projects are committed. All additional assessments for the Phillips-Wangensteen Building are committed for elevators and other shared spaces. JOML has a small balance of funds committed to resolve the glass pipe breakage problems and the Crematory has no funds at all.

Inasmuch as the study primarily affects the Renewal project and the Unit B/C Hospital Outpatient Clinics, we see no real problem with the Hospital Renewal project funding the study.

PJM;jm

Wind Tunnel Analysis



DEPARTMENT OF
AERONAUTICS AND ASTRONAUTICS

CAMBRIDGE, MASSACHUSETTS 02139
ROOM 17-110 (617)253-2270
TELEX 92-1473 CABLE MIT CAM

February 17, 1981

Mr. Paul J. Maupin
Health Sciences Planning Coordinator
University of Minnesota
4103 Powell Hall, Box 75
500 Essex Street S.E.
Minneapolis, Minnesota 55455

Dear Paul:

Thank you for your letter of February 3rd. In regard to the schedule on page 7 of the proposal, if we consider month number one to be February 1981, we are now perhaps one week ahead of schedule. However, I believe the wind tunnel scheduling will cause an additional delay of about one to two weeks, depending on the other tests. Thus I now anticipate that the first test will be complete about March 28th.

When I was out to Minneapolis last we did not really complete the choice of test stations. Further I now feel that some additional questions will arise as we proceed with the model building. Finally you have funded the on-site data acquisition. In view of all of the above I feel a one-day trip to the U. of Minnesota would be appropriate about the first or second week in March to discuss all of the above simultaneously. Alternatively, you may prefer to visit M.I.T. Please let me know your thoughts on this.

Yours very truly,

Frank H. Durgin
Associate Director
Wright Brothers Memorial
Wind Tunnel

FHD:EJM

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
4103 Powell Hall, Box 75
500 Essex Street S.E.
Minneapolis, Minnesota 55455
(612) 373-8981

March 23, 1981

TO: Clinton Hewitt

FROM: Paul Maupin

In response to Mr. Dickler's memo of March 16, 1981 regarding funding for the Wind Study, the current wind condition is a past, present and future problem. The building of Mayo started the wind turbulence condition and each building thereafter increased the problem. The student population and the majority of the staff and faculty are an agile and adaptable group. However, the situation is quite different for Hospital patients and Outpatient clinic clients and relatives. This group is partially incapacitated, feeble, or disabled for a variety of reasons, and attempting entrance to the Health Science Buildings.

University Employees primarily use internal circulation routes between buildings and observation reveals that the group most affected by the wind conditions is the patients and relatives of patients, as a group.

The primary motivation for the Wind Study Project was to provide information that facilitates a design team on Unit J in avoiding amplification of the existing problem and would provide information for a solution to the existing Outpatient Clinics problem at the Unit B/C entrance. We understand from the M.I.T. project director for the wind study that the current design of the Unit J main entrance could possibly create a situation of wind velocity and turbulance exceeding the present situation in severity. It would be short sighted at this point for Unit J planners to ignore an obvious problem and endorse a design that creates additional potential problems with the environment of the Health Science Expansion Project.

I assume the possibility of liability due to past, present and future designs and conditions would motivate the Hospital to invest $44,000.00 if not from an insurance standpoint, then perhaps from a public relations position. However, if you wish, we will terminate the study due to lack of Hospital interest and funds. As you know, none of the other Health Sciences Projects has any funds available at this time to fund the study.

Please let me know what direction the Administration wishes to take.

PM:mka

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
Health Sciences Complex
Box 726 Mayo Memorial Building
Minneapolis, Minnesota 55455
(612) 373-8981

April 9, 1981

Mr. Frank Durgin
Wright Brothers Wind Tunnel
Building 17-110
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Frank:

Would you please prepare a revised schedule of events for us. We assume we will send you the tapes the end of this month. Our main concern is that the testing and report be available by July 1, 1981. Please let me know also, if you have a need for additional stations.

I guess we need to schedule a visit to your laboratory too.

Let me know.

Yours truly,

Tom Kyle

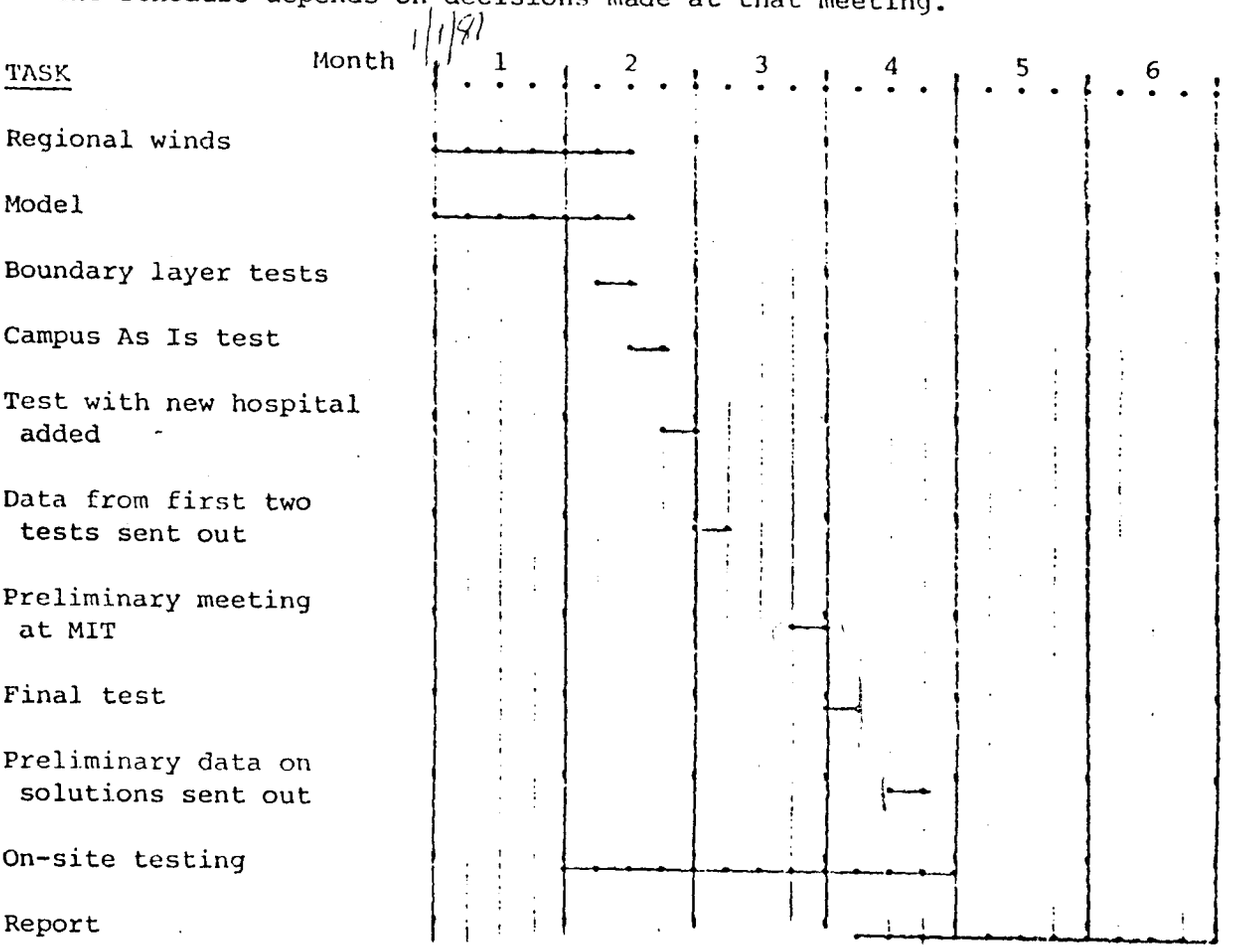
Tom Kyle
Asst. Health Sciences Planning Office

cc: Paul Maupin ✓

TK:mka

VIII. SCHEDULING

Note: The schedule is firm until the meeting at MIT. The remainder of the schedule depends on decisions made at that meeting.



MASSACHUSETTS INSTITUTE OF TECHNOLOGY
77 MASSACHUSETTS AVENUE ROOM E19-702
CAMBRIDGE, MASS. 02139

OFFICE OF SPONSORED PROGRAMS

TELEPHONE (617) 253-9865

May 18, 1981

Acct. No. 90370

University of Minnesota
Office of the Assistant VIce President
Physical Planning
340 Morrill Hall
100 Church Street, SE
Minneapolis, Minnesota 55455

Attn: Clinton N. Hewitt
Assistant Vice President

RE: Research Agreement to Perform Pedestrian Level Wind Study P.O. No. J27861

Gentlemen:

Massachusetts Institute of Technology hereby requests a two (2) month no-cost extension of the referenced agreement through July 31, 1981.

The need for this extension has been discussed by Frank Durgin and Paul Maupin and relates to inappropriate weather conditions.

If this extension is approved please sign and return the attached approval copy of this letter.

Very truly yours,

Patricia K. Greer

Patricia K. Greer
Assistant Director

PKG/mmf
cc: Mr. Durgin
Mr. Maupin

UNIVERSITY OF MINNESOTA
TWIN CITIES

University Hospitals and Clinics
420 Delaware Street S.E.
Minneapolis, Minnesota 55455

MEMO

TO: Paul Maupin

FROM: Greg Kujawa

SUBJECT: MIT Wind Study

DATE: August 11, 1981

During our trip to MIT on July 6, 1981, Frank Durgin indicated that for no additional cost he would include the following in a special section of the wind study:

1) Modified plaza plan with trees and cupola included.

   Ellerbe/HOK to provide an update plaza plan to Mr. Durgin.

2) Delete the Unit J to Masonic overpass.

Please confirm the above. Thank you for your cooperation.

GK/kj

cc Tom Kyle
Donna Ahlgren
John Waugh
Don Denzer

LOCAL WIND DATA
WIND TUNNEL STUDY
UNIVERSITY OF MINNESOTA

DATE	TIME	STATION	WINDS	TEMP	CONDITIONS
3-31-81	1:15 p.m.	19, 18	17 mph South	55°	Rain
4-1-81	1:12 p.m.	17, 14, 11	18-23 mph NW	50°	Cloudy
4-3-81	8:00 a.m.	10, 9, 8	17-22 mph NE	49°	Partly Cloudy
4-9-81	1:00 p.m.	2, 3, 4	16-23 mph SW	65°	Partly Cloudy
4-28-81	1:15 p.m.	21, 20	14 mph N	50°	Partly Cloudy
5-21-81	1:30 p.m.	20, 21	15-23 S	76°	Clear
5-22-81	9:10 a.m.	22, 19	15 mph SE	62°	Clear
5-22-81	10:45 a.m.	18, 17	15 mph SE	62°	Clear
6-1-81	1:35 p.m.	25, 24	22 mph S	76°	Cloudy
6-3-81	1:35 p. m.	15, 16	14 mph W	69°	Cloudy
6-16-81	8:45 a.m.	5, 6	10-20 mph W	56°	Cloudy
6-16-81	1:35 p.m.	7, 13	13 mph NW	61°	Partly Cloudy
6-17-81	1:40 p.m.	1, 23	25 mph S	75°	Clear
6-18-81	1:40 p.m.	2, 5	18-26 mph W	69°	Clear
6-22-81	1:30 p.m.	15, 16	16 mph NW	66°	Partly Cloudy
6-25-81	1:15 p.m.	12, 3	15-23 mph NW	78°	Clear

This information was gathered from the Airport Weather Bureau/

UNIVERSITY OF MINNESOTA

Clinton N. Hewitt

Paul Margin

Let me have your comments

And suggestions on the attached.

Also, A source of funds for

the non-hospital units.

8/24

* Clark Lindsay Hoffman

UNIVERSITY OF MINNESOTA
TWIN CITIES

University Hospitals and Clinics
420 Delaware Street S.E.
Minneapolis, Minnesota 55455

MEMO

TO: Clint Hewitt

FROM: Donna Ahlgren

DATE: August 24, 1981

The reinforcement of the Unit B/C plaza to provide adequate load capacity for fire equipment and the M.I.T. wind study are now nearing completion. As previously indicated, the Renewal Project has provided interim funding for these activities, based upon need for immediate resolution of problems and concerns. As you are aware, there have been a number of memoranda regarding the appropriate allocation of costs for these projects.

The current occupancy of Unit B/C is 45% hospital, 55% non-hospital departments. I suggest that allocation of costs for B/C plaza repair be made on this basis, given the need for adequate fire protection for all occupants.

The M.I.T. wind study is of benefit to the Health Sciences complex as it addresses existing conditions and potential problems which may arise because of Unit J construction. The B/C occupancy rate is not a logical method of cost allocation, however, a request to M.I.T. to allocate their time according to existing condition versus future condition analyses may be most appropriate. Regardless of method, I would reiterate the Hospital's position that the Renewal Project budget should not be solely responsible for this cost.

Please inform me of your actions on these items as soon as possible.

DA/kj

cc John Westerman

UNIVERSITY OF MINNESOTA
TWIN CITIES

Boynton Health Service
410 Church Street S.E.
Minneapolis, Minnesota 55455

August 31, 1981

Memorandum

To: Donna Ahlgren, Assistant Director, Hospital Administration, Box 723 Mayo

From: Andrew J. Streifel, Hospital Environmental Health Specialist; and Jeffrey Smith, Research Assistant; Department of Environmental Health and Safety, Boynton Health Service

Subject: Wind studies, Powell Hall vicinity

In an attempt to determine if weather considerations should be taken into account for the demolition of Powell Hall, a weather study in that vicinity was conducted between July 7 and August 1, 1981. Wind direction and velocity were continuously monitored by a wind recording device placed on the eastern section of Powell Hall roof. In addition to this device, a series of sampling stations around Powell Hall and the Health Sciences complex were evaluated several times a day (see location sample points). A hand-held anemometer was utilized for determining wind speed and direction at ground level. In order to ascertain the relevance of these findings, the data were compared with the KSTP weather tower wind direction readings at 520 feet. These data were provided by KSTP for our use. A total of 21 days were sampled during the study. During those 21 days, 60 separate times were evaluated for wind direction and speed. The results are explained and summarized in the accompanied diagrams. The diagrams are labeled according to respective wind directions from the KSTP tower. Our reference wind direction is superimposed on the top of Powell Hall.

Results

A reasonable correlation was found between the wind directions recorded on Powell Hall and those recorded at KSTP. Our concern lies with the prevalence of south-southeast and east winds. These were the most common winds on the days when the testing was carried out. Bruce Watson, consulting Meteorologist for the Minnesota Pollution Control Agency, compiled a wind rose data information sheet between the years 1964 and 1973. In that document Mr. Watson states: "During the last ten days of August and into the first ten days of September, northerly winds become relatively rare and southeasterly winds, in excess of 12 knots appear once again. Southeasterlies take over from the south-westerlies during the first twenty days of September, a phenomenon which is associated with the intrusion of Gulf of Mexico air back into the area and a secondary rainfall maximum." This, of course, may not occur this year. However, it seems to be a trend which occurs during this time of the year in this area. Please see wind rose information included. The wind rose data indicate that between September 11 to the 20th the prevalent winds will occur from the south and southeast. If a strong wind from these directions should occur on the date of the demolition of Powell Hall, it can be assumed that a great deal of the University Hospitals will be covered with dust. Efforts

should be made to maximize the protection of University Hospitals air intakes and entrances to those buildings. Additionally, efforts to contain the dust by hoses, etc., should be taken as planned. It does not appear to be necessary or feasible to wait for ideal weather conditions, due to the prevalence of these south-southeast winds during this time of the year and the limited number of days otherwise suitable for demolition.

It was noted that wind velocities tend to be lowest in the mornings and increase throughout the day, usually reaching a peak around 3 p.m. In an effort to minimize problems associated with a strong SE wind, we have planned an early morning (10 a.m.) demolition of Powell Hall.

Discussion

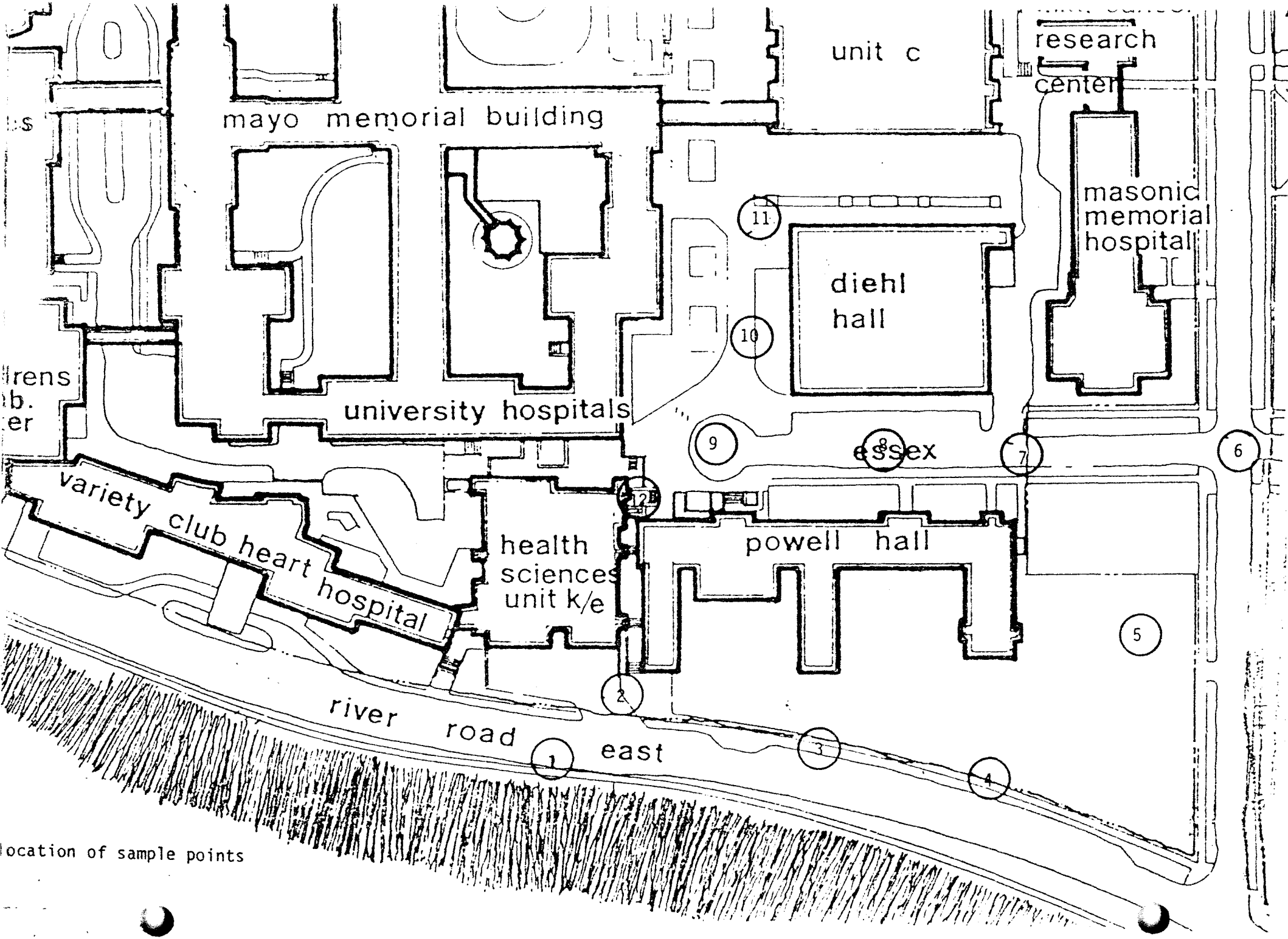
Reliable predictions of weather conditions, at best, can be given no more than 48 hours prior to the event. These predictions will be received by me from the Weather Bureau, prior to September 13th. Our concern lies with the worst case situation, southeast wind 10 + MPH. If such a condition is predicted for the blast date, we still recommend that the blast be carried out at that time. However, contingencies should be established to handle the potential which may result from the dust cloud settling on the University Hospitals. The primary emphasis of our concern lies with those air-handling systems dealing with immune compromised patients (Stations 41, 30, 31, 32, 22, Masonic, KD, Heart 3). Other hospital air systems would be subjected to copious amounts of dust which may foul the working mechanisms of those air filtration units. Preventative maintenance would be the justification for turning them off. We realize, however, that this cannot be accomplished in many instances with simply a flip of the switch. Therefore, contingencies by departments will be made at their best judgment. If, however, the wind prediction for D-day is from the north-northeast-northwest, we will not be as concerned for the overall protection of the complex. The primary emphasis will remain for the above-mentioned stations maximizing their protection, regardless of wind direction. Beyond that, the exercise is merely one for preventative maintenance and does not concern infection control.

From this study, we have a better understanding of the wind directions relative to a reference point (KSTP tower) and the extent of protection necessary for the surrounding buildings. We hope to meet with respective individuals to discuss the coordination of this effort in the near future.

If you have any questions, please feel free to contact me at 373-5935.

AS:ro
cc: Ron Werft
Frank Rhame
Wally Petrokowski
Dick Hendricks
Paul Maupin
Ray Lopez

Enclosures



location of sample points

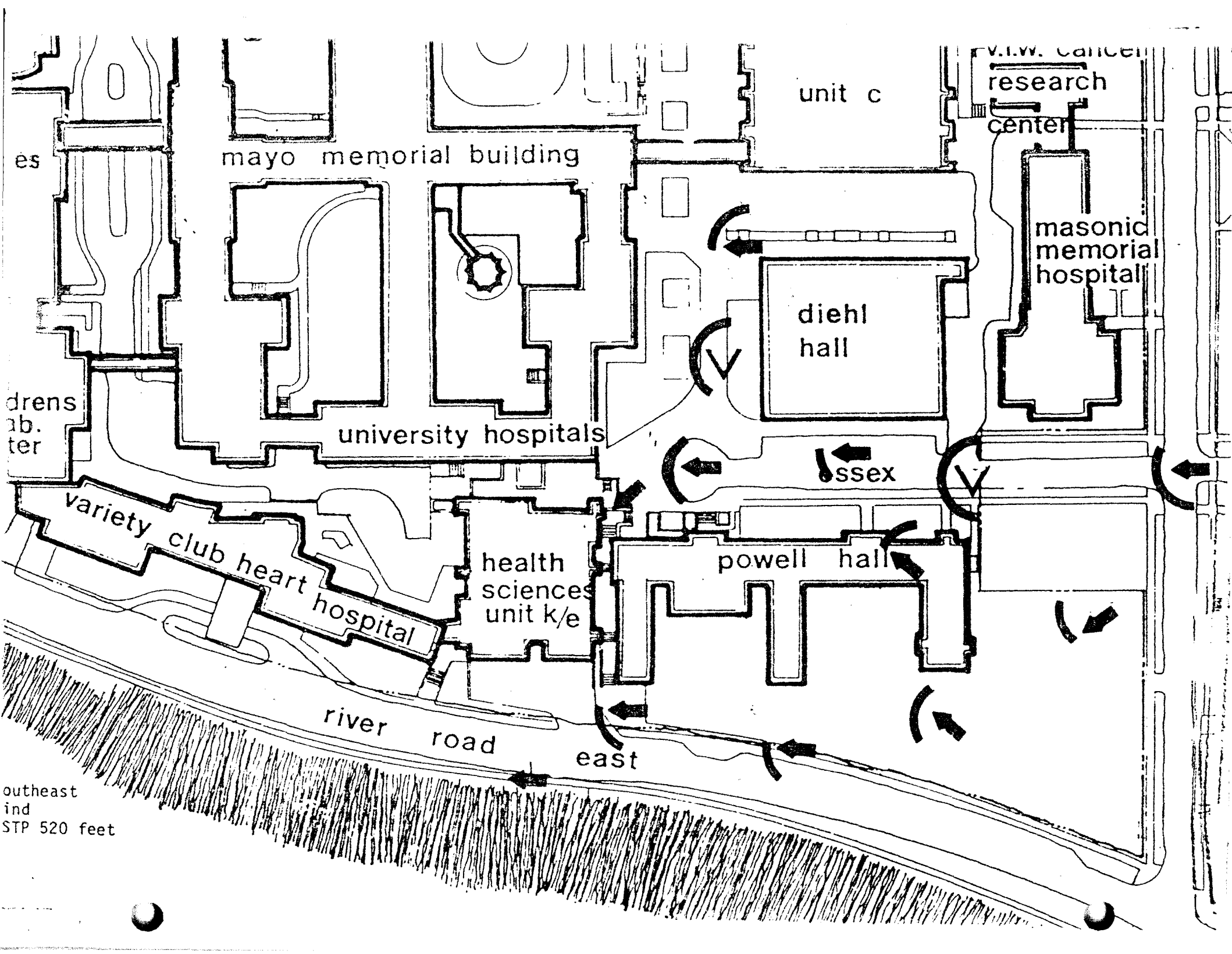
Explaination of symbols in the following diagrams

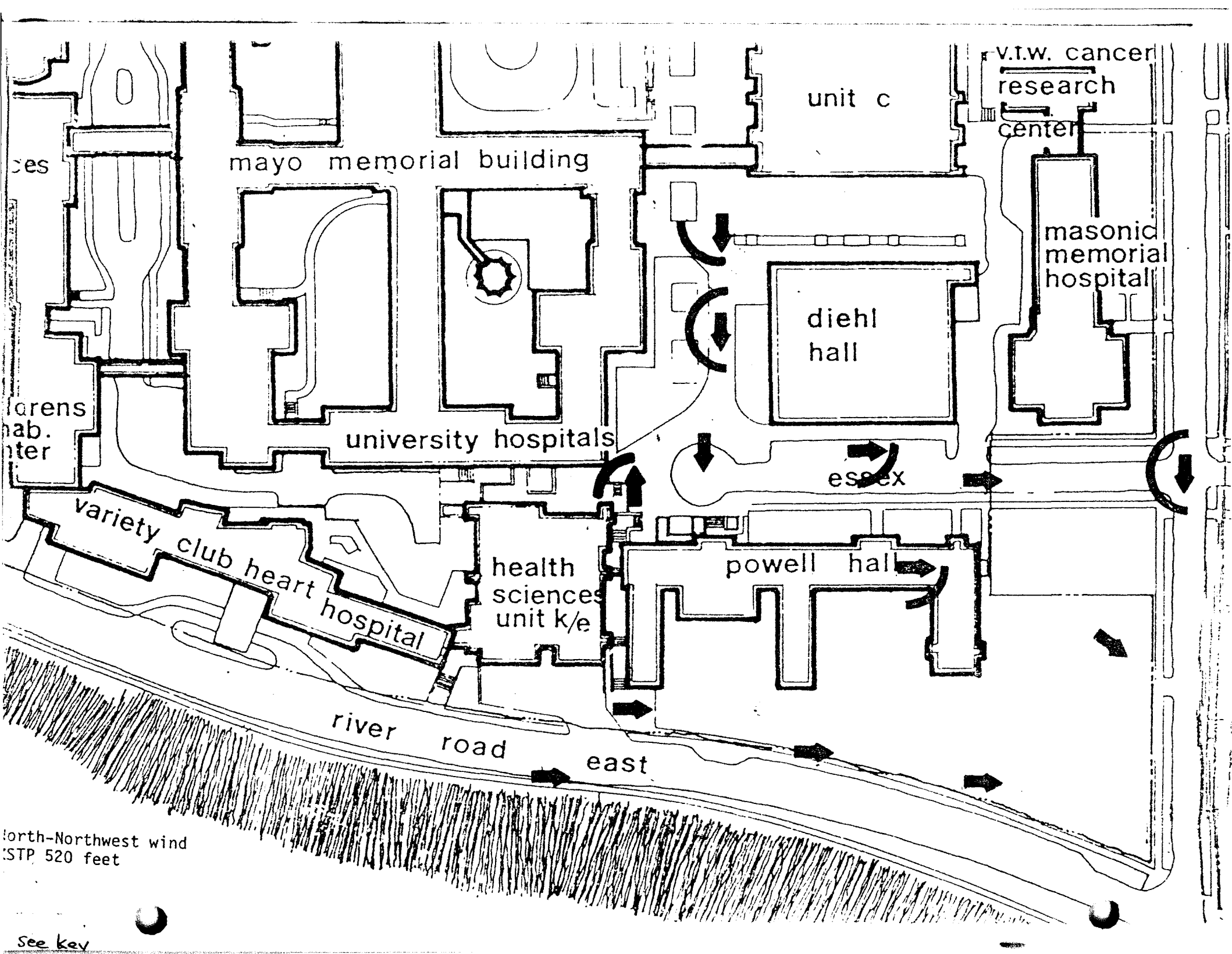
Single arrow means the wind was always blowing from the direction indicated.

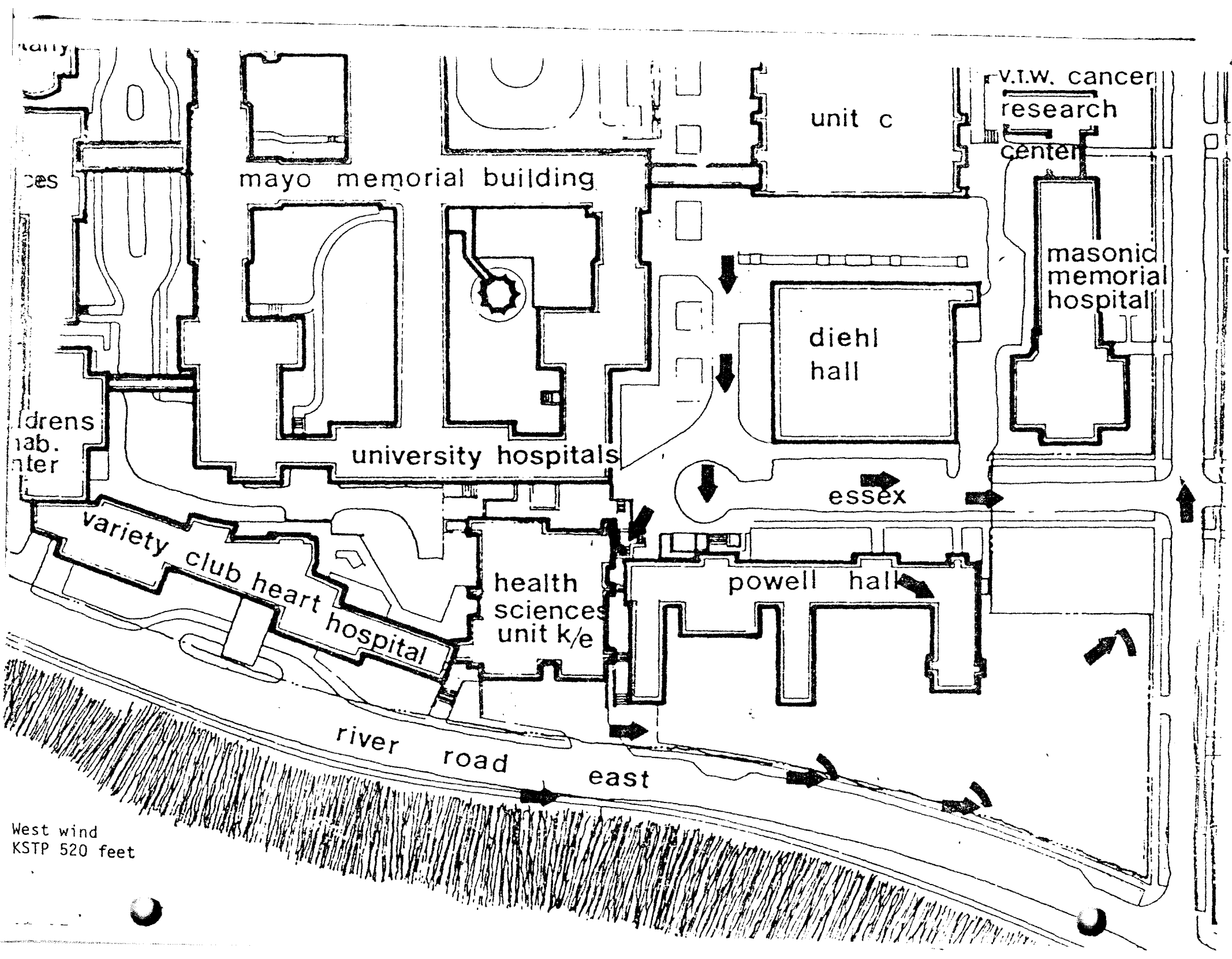
Arrow shows the most prevalent wind direction. The partial circle shows other directions observed but with less frequency than the direction indicated by the arrow.

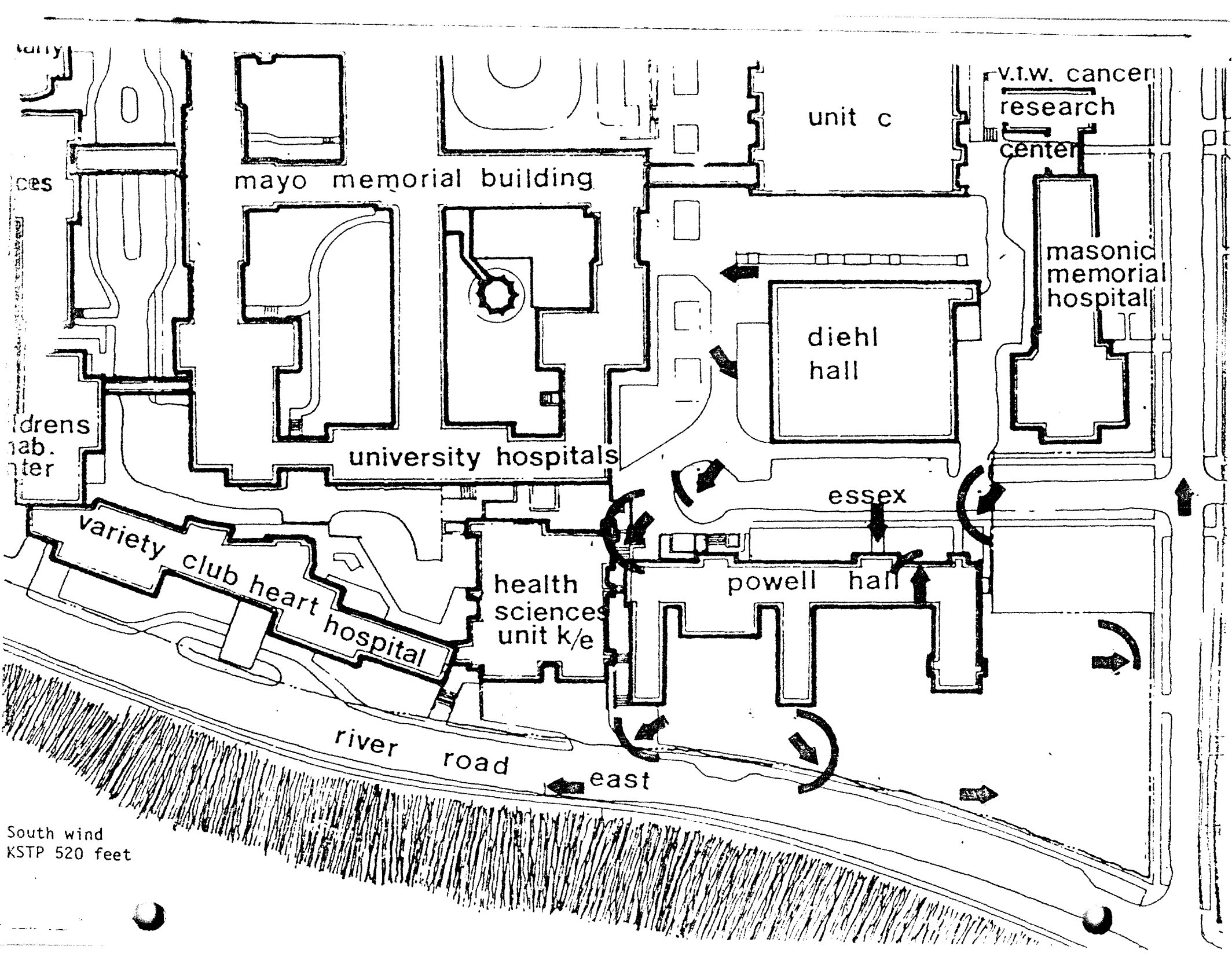
Example: Half circle indicates wind directic was observed ranging fr N to E to S or points i between.

The V indicates variable wind direction; no prevalent direction. The portion of the circle shown indicates wind directions observed.


es
mayo memorial building
unit c
research
center
masonic
memorial
hospital
diehl
hall
university hospitals
ssex
powell hall
variety club heart hospital
health
sciences
unit k/e
river road east
outheast
ind
STP 520 feet


v.t.w. cancer
research
center
unit c
mayo memorial building
masonic
memorial
hospital
diehl
hall
university hospitals
essex
variety club heart hospital
health
sciences
unit k/e
powell hall
river road east
North-Northwest wind
STP 520 feet
See key


mayo memorial building
unit c
V.I.W. cancer research center
masonic memorial hospital
diehl hall
university hospitals
essex
powell hall
health sciences unit k/e
variety club heart hospital
river road east
West wind
KSTP 520 feet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variety club heart hospital
health
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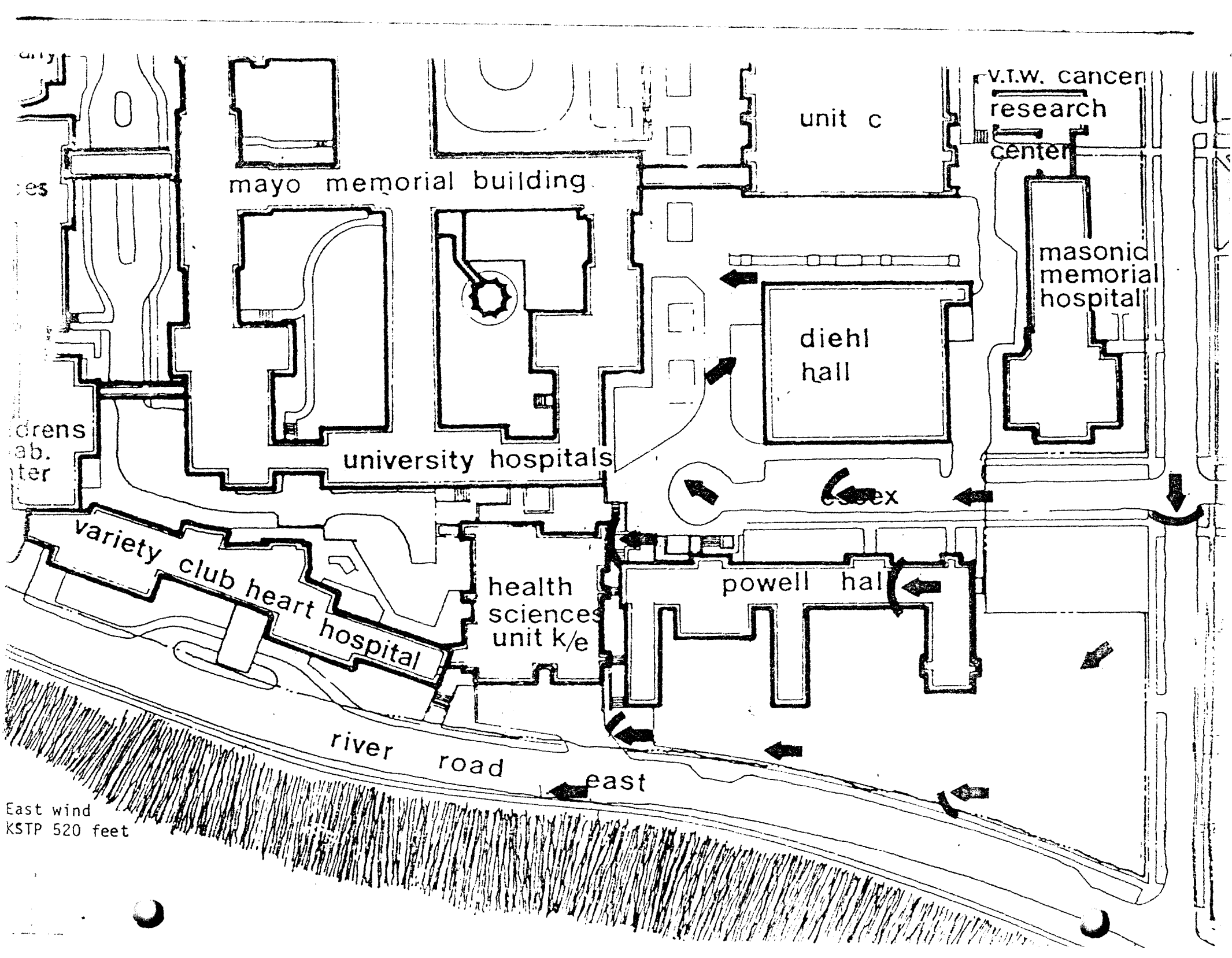
unit k/e
powell hall
river road
east
South wind
KSTP 520 feet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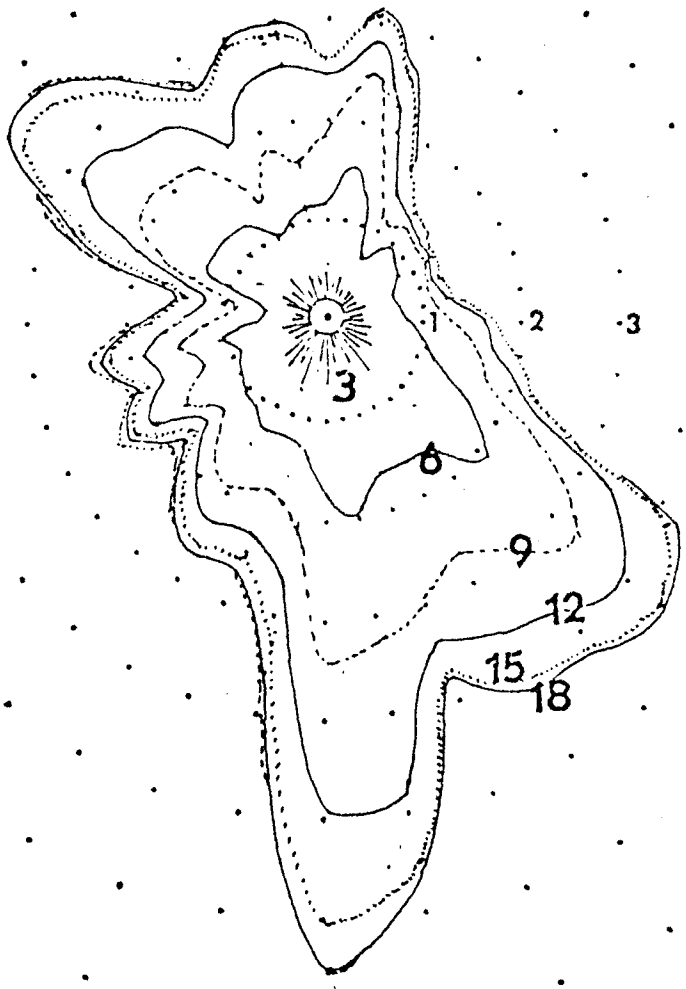
variety club heart hospital
health
sciences
unit k/e
powell hall
river road
east
East wind
KSTP 520 feet

WIND ROSE
SEPTEMBER

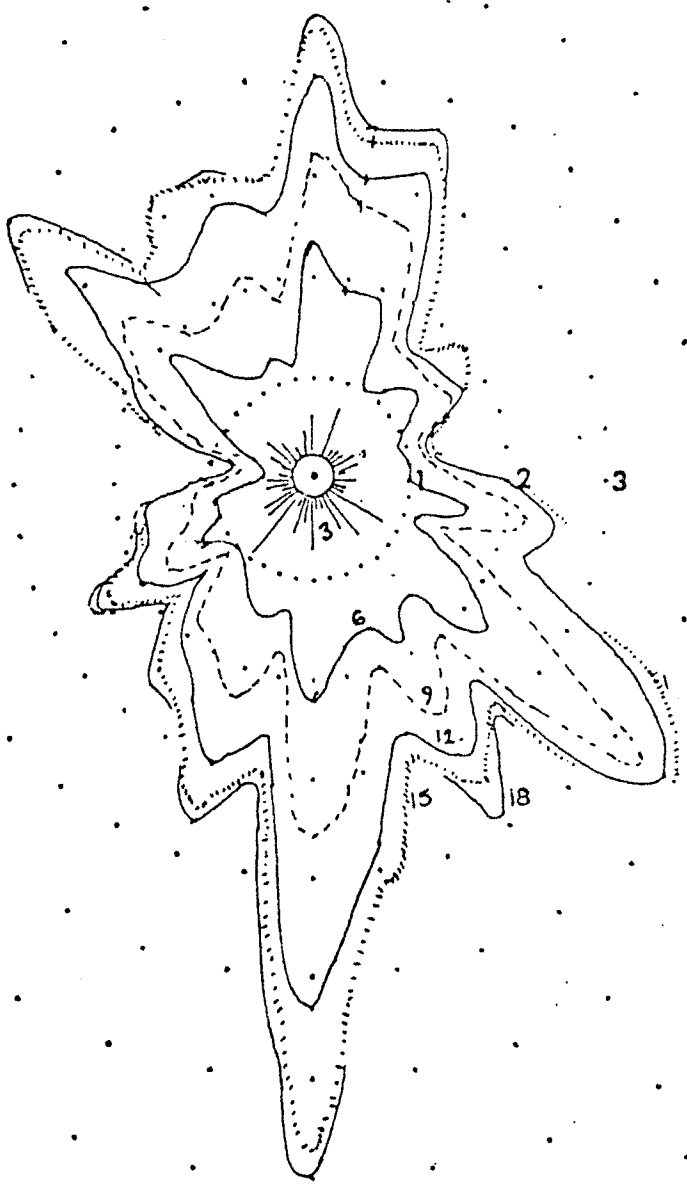
Calm 5%



WIND ROSE

SEPTEMBER 11-20

· CALM 6%



UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
Health Sciences Complex
Box 726 Mayo Memorial Building
Minneapolis, Minnesota 55455
(612) 373-8981

August 17, 1981

TO: Frank Durgin
Wright Brothers Wind Tunnel

FROM: Thomas Kyle
University of Minnesota

SUBJECT: Health Sciences Wind Study
University of Minnesota

After many meetings, here, with Unit J planners and architects as well as our own Environmental Health personnel; it has been decided that no additional tests are required specifically designed around the O.R. fresh air intake on the roof of Unit J or Unit K/E exhausts.

You were going to include, in your final report, tests with current plaza plans including the cupola and a test with the Unit J to Masonic overpass omitted. Also, I think you were to test with the Unit B/C to Unit A link enclosed to structure above.

The site visit to the Wright Brothers Wind Tunnel was very instructive and valuable for the planning of Unit J and we appreciated the time spent with you. We look forward to your report and if you would like to discuss anything please call me.

Thanks again for the informative tour.

TK:mka

cc: Paul Maupin
Donna Ahlgren
Greg Kujawa

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
Health Sciences Complex
Box 726 Mayo Memorial Building
Minneapolis, Minnesota 55455
(612) 373-8981

September 2, 1981

Marshall Bush, Minneapolis Fire Marshall
Fire Department, Room 200
Grain Exchange Building
400 South 4th Street
Minneapolis, Minnesota 55415

Subject: Health Sciences Complex
Fire Access

Dear Mr. Bush:

Sometime during the summer of 1976 during the planning stages of Health Sciences Unit B/C, a fire access plan was developed for the entire Health Sciences Complex by your department based upon campus maps which were sent to you by the Building Code Official.

We would appreciate having a copy of the plan developed for the complex as soon as possible.

Thank you very much for your help in this matter. Should this request present any problem, please contact me.

Very truly yours,

Paul J. Maupin
Health Sciences Planning Coordinator

PJM:jmw

B/C Bldg Codes

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
Health Sciences Complex
Box 726 Mayo Memorial Building
Minneapolis, Minnesota 55455
(612) 373-8981

September 2, 1981

TO: Clint Hewitt

FROM: Paul J. Maupin Paul

SUBJECT: Unit B/C Plaza
MIT Wind Study

In response to Ms. Ahlgren's memorandum of August 24, 1981, we must restate that without the construction of Unit J, we would not have a fire truck access problem. We have attached some of the correspondence we have had with the Fire Marshall over the years while constructing Health Sciences A, B/C and F. Obviously, the department has had ample time throughout the construction of these projects to express fire truck access problems. Just as obviously, inasmuch as all plans and specs were approved by the Fire Department, fire truck access was not a problem until now. Therefore, if the construction of Unit J presents access problems and additional costs are incurred to correct this problem, the Hospital is responsible for these costs.

With regard to the MIT Wind Study, the request for this study came about due to the Hospital Out Patient Clinics' problems with infirmed patients who were having difficulties from time to time. Therefore, the Hospital should pay for this entire effort unless you have an additional source of funds that I am not aware of.

PJM:jmw

Wind Study

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
77 MASSACHUSETTS AVENUE ROOM E19-702
CAMBRIDGE, MASS. 02139

OFFICE OF SPONSORED PROGRAMS

TELEPHONE (617) 253- 3826

September 11, 1981

Acct. No. 90370

University of Minnesota
Office of the Assistant Vice President
Physical Planning
340 Morrill Hall
100 Church Street, NE
Minneapolis, Minnesota 55455

Attn: Clinton N. Hewitt
Assistant Vice President

RE: Research Agreement to Perform Pedestrian Level Wind Study P. O. No. J27861

Gentlemen:

Massachusetts Institute of Technology hereby requests an additional two (2) month no-cost extension of the referenced agreement through October 31, 1981.

The need for this additional extension has resulted from a heavy work schedule at the Wright Brothers Wind Tunnel and further testing on this agreement.

If this extension is approved, please sign and return the attached approval copy of this letter.

Very truly yours,

Heather Kraemer

Heather Kraemer
Assistant Contract Administrator

HK/mmf
Enclosure
cc: Mr. Durgin
Mr. Maupin

Wind Study

Office of the Assistant Vice President

UNIVERSITY OF MINNESOTA
TWIN CITIES

Physical Planning
340 Morrill Hall
100 Church Street S.E.
Minneapolis, Minnesota 55455

January 29, 1982

Mr. Frank Durgin, Assoc. Director
Wright Brothers Wind Tunnel
Building 17-110
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Dear Frank:

I am in receipt of a request from Ms. Kraemer for an additional extension of time to complete the Health Sciences Wind Study. This is the third such request we have received to date.

According to the terms of our agreement dated December 31, 1980, the research was to have been completed over a period from January 2, 1981 through June 30, 1981, with a final report due sixty days following. We are aware of the problems encountered to date with gathering data, etc., however, it is my feeling that ample time has been provided to complete the project.

We are fast approaching the time when this study will no longer be a valid instrument in the planning and design of the Hospital Renewal Project and the Health Sciences Complex.

Therefore, the request for an additional extension of time is not approved and we will expect your final report and analysis to be forthcoming.

Sincerely,

Clinton N. Hewitt
Assistant Vice President
Physical Planning

CNH:jr

cc: Ms. Heather Kraemer
Mr. Paul Maupin

PF

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
Health Sciences Complex
Box 726 Mayo Memorial Building
Minneapolis, Minnesota 55455
(612) 373-8981

June 22, 1982

Mr. Frank Durgin, Assoc. Director
Wright Brothers Wind Tunnel
Building 17-110
Massachusetts Institute of Technology
Cambridge, Mass. 02139

Dear Frank:

This office is at complete loss to understand the continued delay in receiving the Health Sciences Wind Study from your organization. Our many letters and telephone conversations seemingly have no impact in encouraging you to honor your contract with the University of Minnesota.

Please be reminded that the University of Minnesota has expended $41,592.50 and has of this date received nothing.

We are requesting that MIT either submit the study immediately or refund the $41,592.50.

Very truly yours,

Paul J. Maupin
Health Sciences Planning Coordinator

cc: Clint Hewitt
Ms. Heather Kraemer

PJM:jmw

UNIVERSITY OF MINNESOTA
TWIN CITIES

Health Sciences Planning Office
Physical Planning
Health Sciences Complex
Box 726 Mayo Memorial Building
Minneapolis, Minnesota 55455
(612) 373-8981

September 8, 1982

TO: Clint Hewitt

FROM: Paul J. Maupin Paul

SUBJECT: MIT Wind Study History

As you requested, the following is a brief history of the wind study with important facts highlighted.

9/2/80 - Clint Hewitt's initial letter of inquiry to MIT

9/19/80 - Frank Durgin's response to inquiry with cost breakdown for study of $40,000.00

11/11/80 - Letter of agreement submitted to MIT by Office of Physical Planning.

Note item 6: " Furnish at least ten copies of a written report describing the results of the ground wind study and making recommendations for correcting the existing and any anticipated excessive wind problems in the subject Health Sciences area."

11/20/80 - Wind Study Proposal submitted to the University.

Refer to page 6, item VII Reports: " First preliminary results evaluating the proposed wind alleviation solutions will be available two weeks following the meeting at MIT in which the decision on alleviation methods to be tested is made."

12/31/80 - Letter of agreement signed by both the University and MIT.

Terms of work scope are as follows:"The research shall be conducted during a six month period beginning January 2, 1981 and will be subjected to renewal only by mutual agreement of the parties.

Within sixty days of completing this agreement the Institute (MIT) will furnish the Sponsor(U/M) a progress report describing the amount of work complete

to date and the amount of reimbursement billed, etc.

2/3/81 - Paul Maupin requests a schedule of work.

2/17/81 - Frank Durgin advises HSPO that schedule can not be given at that time.

3/16/81 - Durgin here for site visit to meet with the Architects and to bring wind monitoring equipment and instruct HSPO personnel on use.

5/18/81 - First request for extension of 60 days.

7/2/81 - Tom Kyle, Greg Kujawa and three Ellerbe Architects make site visit to MIT. Tom returns equipment and wind tapes.

NOTE: due to rainy conditions here, we are unable to complete the wind monitoring as soon as we had anticipated. HSPO moved in April and that also caused further delay. Each station has to be monitored for 30 minutes at a time. HSPO hours for project were as follows: Paul Maupin, 9 hours, Tom Kyle 170 hours, Joycene Maroney-Walstrom, 40 hours, and Mary Achartz, 320 hours.

9/11/81 - Second extension request for 60 days.

January, 1982 - Third extension for time requested.

January 29. 1982 - Clint's letter to MIT expressing our concern over length of time expended and denial of request for time.

Between January and June, 1982, both Tom Kyle and Joycene placed calls to Frank concerning report. Typical answers were that we'd have it in two weeks and that the computers were down. At one point we were told it didn't matter if time of extension was granted or not, there was no way the report could be finished and gotten to us.

June 22, 1982 - HSPO letter to MIT demanding report or refund.

August 6, 1982 - Report received from MIT.

Throughout the agreements and proposal, it is clearly stated at different times that recommendations would be part of the study. This as we have stated before is the greatest disappointment conerning the report.

If we can be of further assistantce, please call us.

PJM:jmw