

THE UNIVERSITY OF MICHIGAN / Ann Arbor

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March 17, 1960

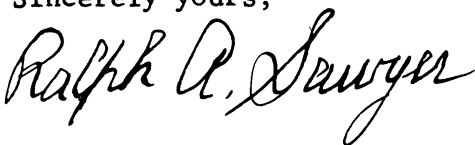
Dr. Henry G. Houghton, Chairman  
University Corporation on Atmospheric Research  
Massachusetts Institute of Technology  
Cambridge, Massachusetts

Dear Dr. Houghton:

The University of Michigan is very much interested in furthering the work of the University Center for Atmospheric Research and would be very pleased to have the University Center for Atmospheric Research locate its headquarters and as many of its activities as may be desirable at The University of Michigan. The enclosed booklet describes the cultural and geographic advantages of the area which I believe are a strong argument for this location. From the land on its North Campus the University would make available to the Center a tract for the location of its headquarters. Other land which the University has nearby is available for locating research operations.

This invitation has the enthusiastic support of the administrative officers and faculty of the University. I believe that the varied opportunities offered by the University and the advantages of living in the community of Ann Arbor would prove pleasant and stimulating to those who will be associated with the Center. The University would welcome an opportunity to discuss the possibility of location in Ann Arbor with your officers.

Sincerely yours,



RAS:b



SITE PROPOSAL  
FOR THE  
UNIVERSITY CENTER  
FOR  
ATMOSPHERIC RESEARCH

Submitted  
to the  
University Corporation  
for  
Atmospheric Research

by

THE UNIVERSITY OF MICHIGAN

Ann Arbor, Michigan, March, 1960



## PREFACE

The selection of a site for the University Center for Atmospheric Research will depend to a large extent on the cumulative importance of those features of possible locations which correspond to the Center's requirements. Most of these features are quite tangible: the size and suitability of the site itself, the geographical relations to state and national centers, the sort of university with which the Center would be most intimately associated, the type of community in which the Center's personnel would make their homes. There is another factor, however, of distinct importance in the choice of the site: the research climate that prevails at a university, that is, the intellectual atmosphere which has so much to do with determining to what degree and in what spirit scientific research is conducted. This is not a matter which can be discussed at length or illustrated with tables and charts, and yet every scientist is aware of its importance. As the following pages will indicate, the Center would find the research climate at The University of Michigan—the intellectual curiosity, willingness to try new ideas and methods, enjoyment of cooperation, in short, the spirit in which scientific work is best performed—well suited for all its purposes.

The information contained in this Proposal is divided into six parts:

- I. The Proposed Site
- II. The University of Michigan
- III. Research Programs in Atmospheric Sciences and Related Fields
- IV. Special Facilities Relevant to the Center's Work
- V. The Community of Ann Arbor
- VI. Temporary and/or Supplementary Site

The general area recommended by The University of Michigan as a permanent site for the Center was selected on the basis of its proximity to the University and housing and to aircraft facilities available on a rental basis. The North Campus area of The University of Michigan currently consists of about 826 acres, with an immediate potential increase to 890 acres. Of this, approximately 450 acres constitute a land reserve to control the development of the areas adjacent to the North Campus building section. The release or sale of any portion of this land reserve is necessarily contingent upon the intended use of the property. Any one portion of this land reserve could accommodate the Center facility; consequently, this proposal will refer only to the general area and not to a specific tract of land of fixed acreage.

The City of Ann Arbor has also made plans for growth and development, designating certain tracts of land for industrial and research purposes. Some of this land is contiguous to the North Campus area and provides supplementary acreage to the area available from the University.

In addition, The University of Michigan has land holdings in the northern part of the State which the Center would be welcome to use for field stations.

Excellent airport and aircraft-maintenance facilities would be available to the Center since The University of Michigan owns the Willow Run Airport and operates associated research laboratories, including an aircraft facility. Temporary office and laboratory space in this complex would also be made available to the Center on a moderate rental basis.

We hope, of course, that this invitation will receive favorable consideration. What follows will show in detail why we believe that such acceptance would prove highly satisfactory both to the Center and The University of Michigan.

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## I. THE PROPOSED SITE

### A. GEOGRAPHICAL ORIENTATION

The proposed site is within the North Campus area of The University of Michigan, approximately 3 miles from the University's Central Campus. The exact location would be agreed upon by the University Corporation for Atmospheric Research and The University of Michigan. An aerial photograph, designated as Map No. 1, shows the location of the North Campus area in relation to the Central Campus and the City of Ann Arbor. The location of the City of Ann Arbor with respect to the City of Detroit and other nearby metropolitan areas is shown on Map No. 2, and the location of this general area relative to the other University Corporation members and to educational institutions that have active research programs situated within a radius of 500 miles, on Map No. 3.

### B. TRANSPORTATION

The City of Ann Arbor is very favorably located as regards air, rail, and highway transportation.

The Willow Run Airport is located 13 miles from Ann Arbor, and the Detroit Metropolitan Airport, 25 miles. Table I, a list of airlines serving the Detroit area, shows the total number of scheduled arrivals and departures for each airline. For more detailed information regarding air transportation and the Willow Run Airport see Part IV, Section A, of this Proposal.

Ann Arbor is located on the main line of the New York Central Railway serving Detroit and Chicago. Railroad passenger service from Detroit is shown in Table II.

The highway and expressway systems serving Ann Arbor are very good and will be even better within the next few years. Map No. 4 shows the general highway system of Michigan and adjacent regions; Map No. 5 shows the present system and Map No. 6 the proposed system for the Ann Arbor district.

#### C. RADIO, TELEVISION, AND MICROWAVE SOURCES

Table III and Maps No. 7 and No. 8 show the transmitter frequencies and power of every unit capable of emitting radio frequency energy within 20 miles of the North Campus and the Willow Run Airport. Excluded from this listing are such devices as amateur radios, radio garage-door operating units, diathermy equipment, etc.

The frequency range of equipment pertinent here extends from 200 kilocycles to nearly 10,000 megacycles, with output powers ranging from 5 watts to 500,000 watts. This equipment is all operated in conformance with the Federal Communications Commission's Standards of Good Engineering Practices, set forth in "Rules and Regulations," Parts 1 through 19.

#### D. RESEARCH AIR SPACE

One of the more important aspects of any proposed location for the University Center for Atmospheric Research is the freedom with which research aircraft can operate. The Michigan location, on the northern fringe of the U. S. airline network, is a distinct advantage. Map No. 9 shows the flight pattern of the regularly scheduled aircraft serving the Michigan and Great Lakes area. It indicates the navigational facilities of the Michigan and adjacent Canadian areas and the degree of freedom for air-research operations.



## E. GENERAL GEOLOGY<sup>1,2,3</sup>

The North Campus area contains unconsolidated deposits laid down by glacier ice during the Pleistocene Epoch. The materials of this restricted area are largely unsorted and unstratified, and are classified geologically as till. The till is approximately 200 feet thick and lies on top of shale bedrock of Mississippian age known as the Coldwater shale. The till is of Wisconsin age and was deposited by the last ice invasion of the Pleistocene glaciers. The tract lies near the crest of the Defiance moraine and the end moraine of the Huron-Erie lobe, which advanced from the southeast out of the Lake Erie basin. The till is generally silty and clayey, but shows considerable textural variation.

## F. TOPOGRAPHY AND DRAINAGE

The surface elevation of the area ranges from 860 to 900 feet above mean sea level, and about 120 to 160 feet above the Huron River to the south. Intermittent surface drainage lines head just north of the tract, converge toward the SW corner, and eventually reach the Huron River about 1-1/2 miles to the south. Subsurface drainage is also in this direction. The topography is rolling, with a well-drained surface.

1. Soil Survey of Washtenaw County, Michigan, by J. O. Veatch, U. S. Dept. of Agriculture, 1930 (with map).
2. Ann Arbor Folio, No. 155, U. S. Geological Survey Atlas of the U. S., by Frank Leverett and I. C. Russell, 1915.
3. Field Manual of Soil Engineering, 3rd edition, Michigan State Highway Dept., 1952.

## G. SOILS

The Soils Map of Washtenaw County (1930) indicates that the main surface soil of this tract is Miami loam. Texturally, a typical analysis shows that the subsoil contains 21% sand, 30% silt, and 39% clay, but considerable variation exists. The extent to which the relatively high silt and clay content would affect foundation conditions and stability under frost action would have to be determined by a study of the engineering properties of the soil.

The soil along the intermittent drainage ways is classified as Washtenaw loam, which has a higher content of fines, especially in the sand sizes, and contains considerably more organic material than the adjoining Miami loam. Washtenaw loam is undesirable as a foundation material, but it can be avoided as a site for structures, even those of considerable size, because it occurs only infrequently within the tract.

## H. WATER SUPPLY

An adequate water supply of acceptable quality is available for the proposed site at reasonable costs.

## I. CLIMATOLOGICAL DATA (WEATHER BUREAU - WILLOW RUN AIRPORT)

Willow Run Airport is located 13 miles east-southeast of Ann Arbor, 4 miles east of the City of Ypsilanti, and 25 miles west-southwest of the City of Detroit. While the terrain is generally level locally, a gradual rise of 120 feet occurs westward from Lake Erie and the Detroit River to the airport, and a further rise of 500 feet extends westward to a range of hills, 75 miles west-southwest to 40 miles north of the weather station. Large bodies of water in the vicinity are: Lake St. Clair, 40 miles east-northeast, and Lake Erie, 30 miles

southeast and east of the station.

The large lakes have a modifying influence on the climate of this area, tempering extremes of both heat and cold. Temperatures of 100 degrees or higher are rare. Cold waves are less severe than in regions adjoining the Lower Peninsula of the State. In addition, the lake effect causes a lag in the seasonal temperature changes, resulting in a climatic condition generally favorable to fruit growing and farming. The growing season averages about 170 days. Normally, the last killing frost in spring occurs about the end of April and the first killing frost in fall near the middle of October.

Precipitation is ample and fairly evenly distributed throughout the year. The wettest period is in late spring and early summer, the driest in late fall and winter. Droughts occur occasionally but are seldom prolonged. Snowfall is not usually heavy and much of it is in the form of flurries.

Dampness and considerable cloudiness prevail in late fall and early winter, but sunshine and lower humidity predominate during summer months.

Prevailing winds are generally southwest. The strongest winds occur in late fall and early spring. Violent wind storms are rare; when they do occur, they are of brief duration, usually associated with thunderstorms. Tornadoes, generally speaking, are rare in southeastern Michigan, although there have been several in recent years, notably in 1953 and 1956.

Weather changes are frequent throughout the year since most cyclonic systems that move eastward across the country pass through or near the Great Lakes region.

Table IV, taken from 1959 Weather Bureau Climatological Data, lists the normals, means, and extremes of temperature, precipitation, relative humidity,

wind, etc., for the Willow Run Airport area.

## J. ATMOSPHERIC POLLUTION

The atmosphere of the Ann Arbor and Willow Run areas is relatively free from industrial pollution. In the Willow Run area are three industrial plants: the Ford Motor Company Hardware and Accessory Division; the General Motors Transmission Division; and the General Motors Corvair Plant. None of these does heavy processing of metals and other materials of the type which produces substantial atmospheric pollution. In Ann Arbor there are only light industry, such as Argus Cameras, and research laboratories, such as those of Parke-Davis and Bendix Systems Division, which release negligible amounts of wastes to the atmosphere.

The prevailing winds carry pollution from the Detroit industrial complex eastward rather than toward Ann Arbor. When east winds do occur, the distance is sufficient to ensure negligible concentration at Willow Run and Ann Arbor. No investigations of industrial air pollution have been made because there have been no indications that an air-pollution problem exists in the area. A few atmospheric samples taken near the School of Public Health of The University of Michigan indicate a normal particulate loading of 60-75  $\mu\text{gm}/\text{m}^3$ . This compares with about 150  $\mu\text{gm}/\text{m}^3$  for the cleaner suburbs of Detroit, 350  $\mu\text{gm}/\text{m}^3$  for central Detroit, and 500-600  $\mu\text{gm}/\text{m}^3$  for the industrial districts of Detroit.

## II. THE UNIVERSITY OF MICHIGAN

The campus area of The University of Michigan, originally a wooded 40-acre tract on the outskirts of the village of Ann Arbor, now comprises more than 1,700 acres in and near Ann Arbor and includes approximately 18,000 acres elsewhere for use of summer camps, branch campuses, and lands used for research.

The Ann Arbor areas of The University of Michigan include the Central Campus, North Campus, Medical Center, Athletic Fields, and Nichols Arboretum. Away from the city, the University has branch campuses at Flint and at Dearborn, and summer stations at Camp Davis, Wyoming (surveying and geology), at Camp Filibert Roth, in Michigan's Upper Peninsula (natural resources and conservation), at Douglas Lake, near Cheboygan (biology), at Northport (speech correction), and at Patterson Lake, near Ann Arbor (education, psychology, and sociology).

Also away from the Ann Arbor campus are the Portage Lake Observatory, a few miles north of Ann Arbor, and the McMath-Hulbert Observatory, near Pontiac. From time to time, the University establishes field offices and participates in research programs in other countries.

Thirteen miles southeast of Ann Arbor is the Willow Run Airport, which the University received as a gift from the War Assets Administration (see Part IV, Section A). The terminal building and the airfield are leased to several major airlines, which maintain these properties. The operation is essentially non-profit so far as the University is concerned, but it enables the University to use a number of buildings at the airport for research in engineering and science (Willow Run Laboratories, see Subsection G5).

Area centers of the Extension Service, which likewise constitute a part of the University's educational system, are located in Ann Arbor, Battle Creek, Dearborn, Detroit, Escanaba, Flint, Grand Rapids, Port Huron, Saginaw, and Traverse City.

#### A. CENTRAL CAMPUS

The Central Campus is the original 40-acre tract, bounded by State Street and North, East, and South University Avenues, and extending outward to include the buildings around this perimeter. The Administration Building (housing executive offices as well as the general administrative offices) and most of the classroom and library buildings are located here. At the edges of this area are the residence halls and the women's athletic buildings and playing fields.

The rate of growth of the Central Campus area has lately decreased, and most future building will take place on the North Campus. Much construction has been completed on the Central Campus in the past decade, the most recent addition being the Undergraduate Library, completed in 1958. A Pharmacy Research Building, adjoining the East Medical Building, is presently under construction.

#### B. NORTH CAMPUS

Across the river to the northeast of the Central Campus is the new North Campus (see Map No. 1). This land was purchased by the University beginning in 1951, and construction of buildings according to a master plan for the area's development is going forward as rapidly as funds become available.

Completed and in use on the North Campus are the Cooley Memorial Building, housing engineering research projects; Phoenix Memorial Laboratory, including

the Ford Nuclear Reactor, for research on peacetime use of atomic energy; Automotive Engineering Laboratory; Aeronautical Engineering Laboratory; Fluids Engineering Laboratory; Civil Defense and Disaster Training Center; Printing Building; and Library Storage Unit, housing the bindery as well as providing storage for library materials.

It is expected that eventually the School of Music, College of Architecture and Design, and School of Education will be located on the North Campus, as will the Material, Metallurgy, and Structures Laboratories, the Highway Engineering Laboratory, the Sanitary Engineering Laboratory, and a classroom and office building—all of the College of Engineering.

#### C. NICHOLS ARBORETUM

The Nichols Arboretum, owned by the University and jointly maintained by the University and the City of Ann Arbor, is open to the public. It comprises about 125 acres of land and contains an unusually varied collection of ornamental trees and shrubs.

#### D. SCHOOLS AND COLLEGES

Seventeen schools and colleges comprise The University of Michigan. The Dearborn Center, which opened in the fall of 1959, is the newest instructional unit. Two other major educational units are the Summer Session and the Extension Service.

The schools and colleges are the following:

- College of Architecture and Design
- School of Business Administration
- Dearborn Center
- School of Dentistry

School of Education  
College of Engineering  
Flint College  
Horace H. Rackham School of Graduate Studies  
Law School  
College of Literature, Science, and the Arts  
Medical School  
School of Music  
School of Natural Resources  
School of Nursing  
College of Pharmacy  
School of Public Health  
School of Social Work

#### E. MEDICAL CENTER

The fundamental purpose of The University of Michigan is education, and all the buildings and functions of the Medical Center serve this objective. The major educational units are the Medical School and the School of Nursing.

The hospitals in the Medical Center are: University Hospital, Women's Hospital, Children's Hospital, Outpatient Building, Simpson Memorial Institute, and Veterans Readjustment Center.

In the fall of 1958, the three-unit Medical Science—School of Nursing Building was occupied. It houses the Departments of Biological Chemistry, Pathology, and Pharmacology, administrative offices of the Medical School, and the School of Nursing. A second unit, to house the remaining departments of the Medical School, has been proposed and funds have been requested from the State Legislature. An additional unit for the Children's Hospital is also planned.

University Hospital, constructed in 1925 and now being extensively remodeled and renovated, is a 722-bed hospital. Women's Hospital (118 beds and 40 bassinets) was completed in 1950. A third major unit is the Outpatient Building,



with facilities for handling as many as 1000 patients daily. Here are located most of the clinics, an extensive Emergency Suite, and the Poison Information and Therapy Center, which provides 24-hour service for any kind of poisoning or suspected poisoning.

Three important psychiatric treatment facilities are part of the Medical Center. The Neuropsychiatric Institute treats adult patients and is also one of the few facilities in the country for intensive treatment of adolescents; the Children's Psychiatric Hospital accommodates about 75 inpatients from ages six to fourteen and offers outpatient treatment to a larger number of disturbed children. The Veterans Readjustment Center is a special service operated by the University for the State of Michigan to provide intensive psychiatric care for veterans. It has facilities for about forty inpatients and ninety outpatients.

Nearly 700 different research projects are underway at The University of Michigan Medical Center with estimated outside support of \$2,500,000. Most of these funds come from foundations, societies, federal agencies, and individual donors.

#### F. RESEARCH LIBRARIES

The book and manuscript collections of The University of Michigan make the University libraries—including the University Library, the Law Library, the Clements Library, and some others—one of the best university library systems in the country.

The University Library includes the General Library, Undergraduate Library, and 26 divisional and branch libraries in other campus buildings. Table V lists

the number of bound volumes in the various units of the entire system. A public catalog of all the University's book holdings is housed in the General Library building, on the second floor, where the Reference and Periodical Rooms are also situated. Each library has a catalog of its own holdings.

The staff of the Center would be welcome to use the University libraries both for research and recreational reading.

#### G. RESEARCH ORGANIZATIONS

Throughout its long history, The University of Michigan has recognized its dual responsibility of disseminating and adding to man's store of knowledge. While the education of young men and women is the University's foremost function, another and an increasingly important function is the research by which members of the faculty are continually extending our knowledge and understanding.

In its programs of education and research, this University has long enjoyed the support of the State of Michigan, the business and industrial community, foundations, government agencies, and private citizens. The interest of, and the assistance received from, all these have enabled the University to become famous the world over for its instruction in the humanities, sciences, and professions, and for the research contributions it has made to nearly all fields of knowledge—science, engineering, medicine, social science, and others.

The following sections briefly describe those research organizations which will be of paramount interest to the Center.

##### 1. Great Lakes Research Institute

The Great Lakes region has always been an important interest of The University of Michigan. The Great Lakes Research Institute was established to en-

courage and integrate fundamental studies of the physical, chemical, biological, and other aspects of the Great Lakes. The principal project of the Institute is a survey of the Lakes themselves, with special attention given to charting currents and accumulating data about water temperatures, meteorological influences, topography of the lake bottom, chemical and mineral content of the water, and biological organisms present in the Lakes. The Institute has the services of a trained oceanographer, who is applying oceanographic techniques to the study of the Great Lakes. It has received financial support from a special Legislative appropriation for research in 1957-59 as well as from general funds of the University.

## 2. Institute of Industrial Health

This Institute conducts extensive research, service, and educational programs involving personnel and facilities of the Medical School and School of Public Health. Among its major research interests are: study of industrial noise and its effect on hearing; periodic health examinations of industrial workers; industrial lighting; industrial hygiene and toxicology; and dermatological studies of the mechanism by which irritating substances affect the skin. Initial support for the Institute came from the General Motors Corporation, which has recently made a supplemental grant of \$350,000. Support for specific projects comes from the U. S. Public Health Service, foundations, and other donors.

The Institute's research equipment of interest to the Center is described in Part III, Section B, of this Proposal.

### 3. Institute of Science and Technology

Established by action of the Regents in July, 1959, and supported by a special Legislative appropriation of \$500,000 for its first year's operation, this Institute is to stimulate advanced work in all the basic sciences, engineering, and technology; to aid in the wide dissemination of results of such work; and to further a fruitful interchange of ideas and knowledge among all educational institutions, industry, and government within the State of Michigan. Through the various programs initiated in its first year, the Institute provides personnel, space, and equipment; fosters exchange programs; arranges conferences, seminars, and symposia on topics of current scientific interest; and seeks to further public interest in, and understanding of, scientific work.

### 4. Michigan Memorial—Phoenix Project

The Phoenix Project has sponsored nearly 200 individual research projects during the eleven years of its existence. It supports research in any field of study involving the use of radiation for peacetime purposes. As a nongovernmental, nonindustrial organization, it has been able to sponsor fundamental research as well as investigations of specific problems. Phoenix funds—over \$8 million contributed by students, alumni, and friends—have provided University scientists with such laboratories as the Phoenix Memorial Laboratory, the Ford Nuclear Reactor, the Plant Nutrition Laboratory, and the Clinical Radioisotope Unit of the University Hospital. Investigations supported by Phoenix funds have produced the bubble chamber for use in nuclear studies (bubble chambers are now being built by research laboratories all over the world); improved autoradiographic techniques; methods for studying the structure and function of individ-

ual cells with radioisotopes; new knowledge about the effects of radiation on food, combustion of fuels, and chemical reactions; etc.

#### 5. Willow Run Laboratories

The Willow Run Laboratories, situated at the east end of Willow Run Airport, 14 miles from the University campus, conduct a broad program of research and development in the fields of engineering and the physical sciences under the sponsorship of government agencies and industry. The program is carried out by a full-time staff of 600, with the participation of members of the teaching faculty, graduate students, and other research groups and laboratories of the University. Research is conducted in thirteen laboratories or departments: Analog Computer, Computation, Countermeasures, Engineering Psychology, Fluid and Solid Mechanics, Information Processing, Infrared, Navigation and Guidance, Operations Research, Radar, Solid-State Physics, Sensory Subsystems, and Special Projects.

During the 1958-59 year, some forty individual research projects made up the \$8,800,000 research program of the Laboratories, primarily for the Federal Government and related to national defense. Project MICHIGAN, which deals with combat surveillance and target acquisition, made up three-fourths of the Laboratories' research activities during the year.

Project MICHIGAN research is leading to new electronic systems and subsystems to receive, transmit, and display tactical information data to provide around-the-clock, all-weather battle-area surveillance. Requirements for sensors of light, sound, heat, movement, and the like, bring the Project deeply into the fields of radar, infrared, acoustics, seismics, and optics. Requirements for airborne sensors result in activities in the navigation and guidance of airborne

platforms. The necessary transmission of data introduces programs in telemetry. The problems of timely collection, transmission, reduction, and collection of sensor data into information useful to military command calls for sophisticated applications of modern data-processing and display techniques. A broad component research and development program is carried on, with strong emphasis on masers and maser action; this is the program which produced the ruby maser.

#### 6. The University of Michigan Research Institute

This is the University organization which administers research grants and contracts for all units of the University. Its origins date back to 1920, when the Department of Engineering Research was established. Since World War II, the Institute has grown phenomenally. In 1958-59, research grants and contracts totaling nearly \$16,000,000 were administered; for the current academic year the total is likely to be around \$22,000,000. The Institute supports sponsored research activities by administering research grants and contracts and by making available such service units as editing, technical typing, technical illustration, photography, reports reproduction, security, and several instrumentation facilities.

#### 7. Other Research Institutes and Laboratories

The preceding paragraphs have described those University research institutes and laboratories whose work has some direct bearing on the future activities of the Center. Other University research units are listed below.

Bureau of Industrial Relations  
Institute for Social Research  
Center for Research on Conflict Resolution  
Institute for Human Adjustment

Institute of Public Administration  
Bureau of Business Research  
Legislative Research Center  
Bureau of Public Health Economics  
Simpson Memorial Institute for Medical Research  
Cancer Research Institute  
Rackham Arthritis Research Unit  
Mental Health Research Institute

#### H. RESEARCH PERSONNEL AND STUDENTS

The University of Michigan faculty is noted for its many outstanding scholars in a great variety of disciplines. Most of those in the physical sciences and engineering have experienced the benefits of working with specialists in disciplines other than their own, often as a result of their participation in sponsored research. They are assisted in much of their work by a full-time staff of research associates and technicians.

The University's long-established policy, to integrate the teaching and research activities of its faculty, has produced clear-cut benefits not only in the classroom and the laboratory, but also for the sponsors of University-conducted research. The Center would find the University faculty, which has one-fifth of its time freed for research work, highly receptive to opportunities to work on problems in the atmospheric sciences.

About 38% of the University's 24,000 students are enrolled in the Graduate School or in one of the professional schools. Many of them find opportunities to participate on either a part-time or full-time basis in the University's research programs. About 1000 students per year are employed as part-time assistants on sponsored research projects administered through The University of Michigan Research Institute. And every year students are coauthors of

scores of journal articles based on research projects directed by faculty members. Also, a considerable number of doctoral dissertations result from this work.

It may be of interest to note that The University of Michigan ranks high among state universities in respect to the rating of entering freshmen in their high school graduating classes.

The cosmopolitan nature of the University's student body is illustrated both in Table VI, which lists the students' origin by selected geographical regions, and in Table VII, which lists their distribution in the University's 17 schools and colleges.

The supply of scientific manpower in the Ann Arbor area is as good as that anywhere in the country. The University—Ann Arbor environment has attracted outstanding scholars in all fields of learning. If the Corporation decides to accept the invitation offered herein, the Center will no doubt benefit equally from this environment. A factual presentation of what the community of Ann Arbor has to offer newcomers is given in the last part of this Proposal.

Part III of this Proposal describes the University's research programs in atmospheric sciences and related areas, as well as the special equipment used in these investigations; Part IV deals with other University facilities relevant to the Center's work. All laboratories are staffed with competent scientists and technicians, who work under the direction of members of the teaching faculty. Everyone would cooperate with the Center to the fullest extent possible.



### III. RESEARCH PROGRAMS IN ATMOSPHERIC SCIENCES AND RELATED FIELDS

#### A. GENERAL UNIVERSITY FACILITIES

The University of Michigan is actively engaged in a number of fields of atmospheric research. These will be described in broad categories.

##### 1. The High Atmosphere

Most of the research in this area is being conducted by two rocket groups, which have been active since the end of World War II and participated extensively in the I.G.Y.

##### (a) Space Physics Research and High-Altitude Engineering Laboratories.—

The pressure, temperature, density, and composition of the atmosphere from 30 to 200 km are being studied in rocket programs. The charged-particle structure of the ionosphere is also being investigated by rocket soundings. An improved rocket vehicle is under development for carrying upper-air sensors to heights of from 150 to 1800 km. Another phase is concerned with radiation studies in the visible and near-infrared regions by high-resolution and low-resolution radiometers mounted both on rockets and satellites.

##### 2. Cloud and Precipitation Physics

(a) Development of, and Field Research with, a Photoelectric Raindrop-Size Spectrometer.—The development of this instrument is nearing completion. The instrument has been field-tested, and raindrop-size spectra have been obtained. The next step in this investigation is to study in detail the raindrop spectra of rain produced

by the various precipitation-generating processes in the atmosphere in order to elucidate the fundamental physical mechanisms involved. Plans for the future include the development and use of an airborne photoelectric raindrop-size spectrometer.

(b) Field Research with Aerodynamic Raindrop Sorter.—This instrument differs fundamentally from that described above in that it collects raindrops in various mass ranges with a view to chemical and physical analysis of contained matter. The instrument is in the initial stage. Theoretical calculations carried out with an analog computer have been compared with observations made with the sorter. It offers a second significant method for the analysis of condensation and precipitation mechanisms in the atmosphere.

(c) Laboratory Study of the Influence of Turbulence on Cloud-Droplet Growth.—A cloud chamber has been developed in which monodisperse systems of cloud droplets may be produced. A method of generating reproducible patterns of turbulence within the cloud chamber is being perfected. The apparatus holds promise of clarifying our understanding of the physical processes by which cloud-droplet growth occurs.

(d) Radar Analysis of Precipitation Mechanisms by the University's Mobile Weather Radar Research Unit.—Radar photographs of many precipitating cloud systems have been obtained, and detailed analysis of these will commence shortly. Plans for the future call for radar analysis of precipitation simultaneously with studies using the photoelectric raindrop-size spectrometer and the aerodynamic raindrop sorter.

### 3. Micrometeorology

(a) Atmospheric Dispersion of Large Particulates.—This research is concerned with the emission, transport, diffusion, and deposition of natural particulates of relatively large size (e.g., ragweed pollen of diameter  $20\mu$ ). The complex processes of atmospheric dispersion are being studied by field experiments both during the regular ragweed season and using ragweed plants induced to pollinate extraseasonally.

(b) Atmospheric Diffusion of Fine Particulates.—Diffusion patterns of fluorescent particles with diameters of several microns released at a shoreline station to flow out and over the surface of a large lake are being measured by airplane sampling. The pertinent meteorological parameters are being measured simultaneously. These experiments will yield much fundamental knowledge about "diffusion in transitional states."

(c) Land and Lake Breezes.—An instrumented meteorological tower located at the shoreline of Lake Erie, one hundred yards from the Enrico Fermi Nuclear Power Plant and 40 miles from Ann Arbor, is yielding much new information on the development of land and lake breezes and providing a sound basis for an improved understanding of these phenomena.

(d) Wind Stresses Over a Lake Surface.—Precise measurements of the wind-speed profile over the surface of a large lake have yielded values of the wind stress on the lake surface as a function of wind speed. These measurements are expected to clarify a number of unsolved problems.

(e) Atmospheric Turbulence Along Horizontal Paths.—A photoelectric detector of scintillations induced by atmospheric turbulence in a light beam tra-

versing a long horizontal path is being employed to analyze the scintillation patterns as functions of lapse rate, surface roughness, height above surface, wind direction, and wind speed. A number of significant results have been obtained, and the research is being expanded.

(f) The Heat Budget Near Snow Surfaces.—The complex heat economy of snow surfaces is being investigated by a program of measurements at a field station in Michigan's Keewenaw Peninsula, which extends into Lake Superior.

#### 4. Instrumentation Design

(a) A Fast-Response Recording Bivane.—A bi-directional wind vane of novel design has been developed for detailed studies of turbulence required in micro-meteorology. The bivane has been shown to have excellent performance characteristics.

(b) A Recording Gust Accelerometer.—A bridled-cup anemometer of special design for turbulence studies has proven its value. Present plans include the development of a faster-response instrument.

(c) The Dynamic Response of Wind Vanes.—Mathematical and wind-tunnel studies of the dynamic response of wind vanes have been carried out. These studies will provide the basis for improved designs in the future.

(d) An Isokinetic Volumetric Sampler for Particulates.—A sampler of new design to permit true isokinetic volumetric sampling of atmospheric particulates has been developed, but requires additional testing and refinement.

#### B. FACILITIES OF THE INSTITUTE OF INDUSTRIAL HEALTH

A vital part of a complete program of atmospheric research concerns the effects of the atmosphere on health. The Institute of Industrial Health, the School

of Public Health, and the Medical Center have well-trained personnel experienced in studying the effects on health of inhaling polluted air, as well as outstanding facilities for such research.

### 1. Toxicology Laboratories

The new toxicology laboratories include fully equipped chemical and biological laboratories, animal quarters, animal exposure chambers, cold-storage facilities, a diet kitchen, and a dish-washing room. The animal exposure room contains four large stainless-steel inhalation chambers (6 x 6 x 6 ft). Each of these chambers is individually air-conditioned with humidity, temperature, and air-flow controls. These chambers can be operated continuously to expose large numbers of animals to various types of artificially prepared atmospheres over long periods of time. Two smaller stainless-steel inhalation chambers are also available for use with smaller groups of animals and for shorter periods of time. Laboratory equipment is also available to carry out a variety of biochemical studies on the exposed animals.

### 2. Instrumentation

The physics instrumentation section is a laboratory facility staffed with personnel trained to carry out work in emission spectroscopy, including the visible, ultra-violet, and X-ray regions; absorption spectroscopy in the visible, ultra-violet, and infrared regions; X-ray diffraction; and gas chromatography.

This laboratory was designed to conduct research on those health problems that can be approached and investigated by the use of physical instrumentation. This basic instrumentation, however, can be used in a wide variety of atmospheric problems.

Along with the exposure chambers and other laboratory facilities, the instrumentation of the Institute can be used to simulate and study innumerable atmospheric conditions as related to health. These facilities would permit observation of physiological responses of long-term exposure to low concentrations of contaminants in the atmosphere.

The School of Public Health now offers a sequence of graduate courses on community air-pollution control, covering health effects, sampling, instrumentation, and analysis.

### C. SUPPORTING FACILITIES

The University of Michigan is unusually well equipped with facilities that could be used in support of a program of fundamental research in the atmospheric sciences. Some of these facilities are:

1. Telescopes and radiotelescopes, for the study of planetary atmospheres and of solar-terrestrial relationships. (For a detailed discussion see Part IV, Section E.)
2. Radar design laboratories, with personnel competent to advise on new research weather-radar systems of the most advanced types.
3. The Radiation Laboratory (staff of nearly 100), for the theoretical and experimental study of electromagnetic radiation, such as array and antenna theory, electromagnetic radiation and scattering, radar absorption, radar cross sections, tropospheric scattering, magnetohydrodynamics, plasma theory, dielectric properties of polar liquids, and experimental design for probing the planets.

4. The Infrared Laboratories in the Randall Building, providing the possibility of laboratory research on infrared radiation under specified and controlled conditions. Such research has provided much basic information which has proved to be invaluable in the study of infrared radiation in the atmosphere.
5. The Instrumentation Laboratories, affording the competence and resources to assist in the solution of the most complex problems of modern meteorological instrumentation.
6. The Ford Reactor and the Memorial Phoenix Laboratory, available to supply radioactive tracer substances for the analysis of complicated physical atmospheric processes.
7. The Radiocarbon Dating Laboratory, providing an opportunity for special research in the broad area of paleometeorology.





#### IV. SPECIAL FACILITIES RELEVANT TO THE CENTER'S WORK

##### A. AIRPORT AND AIRCRAFT FACILITY

Willow Run Airport is located 13 miles from Ann Arbor, 30 miles from Detroit, and 12 miles from Detroit Metropolitan Airport.

##### 1. Airlines

Southeastern Michigan is served by 10 trunk carriers and 4 local service carriers: Capital Airlines, Trans-World Airlines, United Air Lines, and Eastern Air Lines presently operate from Willow Run Airport; North Central, Lake Central, and Mohawk Airlines, as local service carriers, also operate from that airport. American, Northwest, Delta, Trans-Canada, Pan American, and B.O.A.C. operate from Detroit Metropolitan Airport; Allegheny Airlines is the local service carrier from that airport. There are 660 scheduled arrivals and departures daily by the above carriers. The routes of these airlines serve the Detroit area with direct schedules to all the major cities of the United States. The Detroit area service is approximately sixth in the volume of scheduled airline traffic. Table I lists the airlines serving the Detroit area and the number of scheduled arrivals and departures for each airline.

##### 2. Traffic and Navigation Aids

The air traffic routes are predominately traveled east and west between Detroit and Chicago and Detroit and New York. The other heavily traveled airways are to the south, southwest, and southeast. A minimum of air traffic is to the north, to the smaller communities of Michigan.

All the air traffic approaching or departing from Detroit is controlled by the Federal Aviation Agency Control Tower located at Willow Run Airport. The navigational aids employed for air traffic control at this airport are Radar Approach Control and Radar Departure Control, which in turn utilize the following aids: Airport Surveillance Radar, Terminal Visual Omni-Directional Range, Instrument Landing System, Distance Measuring Equipment, V.H.F. Direction Finder, Precision Approach Radar (G.C.A.), High-Intensity Runway Lights on the Instrument Runway, High-Intensity Approach Lights with sequence strobe-light flashers, Transissometer, and TSO-N10A Runway Marking (all-weather runway marking), which creates a runway visual range allowing a horizontal visibility of 2600 feet with zero ceiling.

Willow Run Airport is capable of handling jet aircraft. Military F-84s and B-57s used it when the 10th Air Force Reserve and the 30th Air Division were based at the airport. United Airlines uses this airport as an alternate field to Chicago O'Hare for DC-8 passenger aircraft when weather necessitates by-passing Chicago. T.W.A. is planning to use the airport for Boeing 707 passenger aircraft beginning in 1960.

The navigation aids at Willow Run Airport, the cleared approaches to the runways, and the eight-direction runway system provide one of the finest operational airports for all-weather flying in the United States. Research aircraft can operate at this airport at zero ceiling and zero horizontal visibility.

Willow Run Airport has two fuel-farm facilities for both gasoline and jet fuel. The hangar facilities will house all but Boeing 707 and DC-8 aircraft;

however, the hangar doors can be modified to house all but the tail sections of these aircraft.

The Willow Run Airport was designed for bomber use, and therefore the facilities are adequate for any type of heavy aircraft.

### 3. Use and Size of Area

The following is a list of the areas and sizes of Willow Run Airport and its installations on the west side of the field. (See also Map No. 10.)

(a) Acreage	1986 acres
(b) Runways	
6 runways	160 ft wide
9R-27L	6502 ft long
9L-27R	7283 ft long
5R-23L (instrument runway)	7339 ft long
5L-23R	6470 ft long
14-32	6616 ft long
18-36	6886 ft long
(c) Terminal Space	82,840 sq ft
Hangar No. 1 balcony	
Offices and ready rooms under the observation deck (8,000 sq ft)	
From the south wall to the north wall of the lobby area	
(d) Hangar Space (does not include office space)	
Hangar No. 1	296,500 sq ft
Hangar No. 2	228,000 sq ft
Warm-up Hangar	32,258 sq ft
(one-half used for hangar purposes, the other for storage)	
(e) Office Space	
Center section of Hangar No. 1	35,400 sq ft
Balcony, center section, Hangar No. 1	72,000 sq ft
Hangar No. 2	37,000 sq ft
(f) Hotel (Lobby Area)	20 rooms
19 rental rooms	
1 for manager	

(g) Parking Lot		
Capacity		3,500 cars
Approximate size		20 acres
(h) Lobby Space		
Public areas		19,694 sq ft
(This does not include areas assigned to a specific purpose, such as booths, seats, displays, etc.)		
Includes restrooms, aisle space, but not cafeteria and dining rooms.		
(i) Maintenance Hangar Space		24,000 sq ft
Bay 5 and the area behind it		
(j) Post Office		8,746 sq ft
(1500 sq ft of this on the Balcony)		
(k) Air Freight		7,533 sq ft
(l) Railway Express		4,357 sq ft
(m) Concourses		735 ft long 12 ft wide
(n) Dining Room Capacity		
Cafeteria (seating) Customers	136	
Employees	<u>16</u>	
		152
Dining Room (including private room)		140
Cocktail Lounge		84
Snack Bar (all stand-up)		<u>20</u>
	Total	<u>396</u>

#### B. WILLOW RUN LABORATORIES' AIRCRAFT FACILITY AND PERSONNEL

The University's Willow Run Laboratories use eight government-furnished aircraft in connection with sponsored research activities. The staff of this facility not only maintains, repairs, and pilots these aircraft, but—most important to the Center—makes all possible alterations to airframes and installs new instrumentation and a variety of sensing devices.

### C. COMPUTER FACILITIES

In 1959 The University of Michigan established a Computing Center to be maintained as a research and service activity with the Graduate School. The Center provides consultation and computing service for teaching and research units of the University and for members of the faculty and for students who are in need of such service in the pursuance of research. It correlates the interests and efforts of the faculty engaged in instruction and research in computing and data-processing. This facility has an IBM 704 with peripheral equipment, and arrangements can be made for its use.

The Ford Foundation has approved a grant of \$900,000 to The Regents of The University of Michigan to be used over a period of up to three years for the multidepartmental use of computers to enrich engineering education. This program will be developed as a method of improving the use of electronic computers for class instruction, with participation by faculty and students from all departments and at all levels. Approximately \$300,000 of this grant will be used for the provision of computer facilities, approximately \$350,000 for visiting faculty members from other institutions and for post-doctoral teaching interns, and approximately \$250,000 for the operation of the project, including costs of computer consultants and assistants, summer conferences, and reports.

The Willow Run Laboratories of the University have additional computer facilities: a general-purpose electronic analog computer with over 300 operational amplifiers, plus extensive function-generating and plotting devices; an IBM 650 digital computer; a Royal-McBee LGP-30 digital computer; and a variety of special-purpose data-processing equipment.

## D. TECHNICAL INFORMATION AND ANALYSIS CENTERS

### 1. IRIA

The Infrared Information and Analysis Center was established at the Willow Run Laboratories five years ago, under tri-service sponsorship, for the collection, analysis, and proper dissemination of information about infrared research and technology, with particular emphasis on military technology.

In its central clearinghouse role, IRIA maintains a comprehensive and timely infrared-information collection system and a mechanized information storage-and-retrieval system for meeting the needs of many of the nation's scientists. Particular attention is given to the acquisition of up-to-date contractor reports.

This information is analyzed for content and value and cataloged according to the type of research or technology discussed. This enables IRIA to provide contractors with the proper information about a specific development or with evaluative surveys of broad trends of research and development.

### 2. BAMIRAC

The Ballistic Missile Radiation Analysis Center of the Willow Run Laboratories, under the sponsorship of the U. S. Air Force, stores and analyzes the available reduced data on the electromagnetic and acoustic radiation emanating from, or caused by, ICBM's and IRBM's during their entire trajectory, from launch to impact, and correlates these data with parameters of the missile and its environment. A magnetic-type data-storage-and-retrieval system centered on IBM 704 data-processing equipment has been designed for this project. Both data to be stored and requests for data retrieval enter the system via punched cards. Major indexing is based on a system of key words and phrases. Data and

associated indexing information are stored on separate tapes for efficient tape-research procedures.

## E. SPECIAL DEPARTMENTAL FACILITIES

### 1. Astronomy

The Observatories of The University of Michigan possess a variety of specialized equipment which is employed for astronomical research. The major areas of astronomy in which the University specializes are stellar astrophysics, solar physics, and radioastronomy.

For research in solar physics, there are a variety of solar telescopes contained in the 50-ft and 70-ft towers of the McMath-Hulbert Observatory, near Pontiac. These towers contain optical trains that produce images of the sun of various diameters, ranging from about  $3/4$  inch to 11 inches. These solar images may be photographed in white light or in any one of several sharply monochromatic wavelengths. Several powerful spectrographs may also be employed in conjunction with the solar telescopes. The spectrum may either be photographed or it may be scanned with a variety of photoelectric and photoconductive detectors, covering the spectrum from  $3000\text{\AA}$  to about 20 microns.

In addition to the major equipment in the solar towers, the McMath-Hulbert Observatory also possesses a photoheliograph, consisting of a 6-inch refracting telescope and narrow-band interference filter for photography of the sun in the red light of hydrogen; apparatus for detecting and measuring cosmic radio noise at 18 megacycles and at 226 megacycles; magnetometers for measuring variations in the earth's magnetic field; and an array of auxiliary laboratory equipment for the measurement and reduction of data, such as microdensitometers, measuring engines, etc.

Research in stellar astrophysics is carried on with a 37-inch reflecting telescope at Ann Arbor and a 24-inch reflecting telescope and a 24-36-inch Schmidt-type telescope at the Portage Lake Observatory. These telescopes are equipped with a variety of accessories, such as objective prisms, spectrographs, and photoelectric scanning spectrometers. Photoelectric photometers may also be used with or without color filters to measure the brightnesses of stars and nebulae.

The specialized equipment of the radioastronomy observatory at Portage Lake includes two large paraboloidal antennas, both equatorially mounted and both steerable over virtually the entire sky. One antenna is 28 feet in diameter and is equipped with sweep-frequency receivers for the observation of the radiofrequency spectrum of the sun from 100 to 600 megacycles. A second, lately dedicated radiotelescope, 85 feet in diameter, will be operated initially with a broad-band radiometer at a 4-cm wavelength. Both radiotelescopes are able to detect and measure efficiently radio waves from 3 centimeters to the ionospheric cut-off at about 20 meters. The equipment of the radio observatory also includes a minitrack system for the location of artificial satellites and an assortment of auxiliary receivers and test equipment. A maser-type receiver is expected to be in use with the 85-foot telescope early in 1960.

Essentially, all the equipment described above falls into the "unusual" category; much of it is unique in the world.

## 2. Physics

The Physics Department possesses magnetic resonance equipment, detectors, and counter circuits for nuclear correlation experiments, a 12-Mev cyclotron,



X-ray diffraction apparatus for the study of molecular structure, a number of infrared spectrometers including an instrument with one of the highest resolving powers in the world, bubble chambers for measuring high-energy particles and two elaborate optical systems for analyzing the film, and an automatic nuclear emulsion scanner (the only one in the world). Most of these facilities could be made available to qualified scientists, subject to scheduling their work into the present programs. Few, if any, of the facilities could, however, be moved from their present locations.

### 3. Geology

The seismograph equipment in the fixed station and in the portable station, and the geophysical prospecting equipment consisting of several magnetometers, gravity meters, etc., provide basic equipment for teaching and research in this department.

### 4. Forestry

The Department of Forestry, one of five departments in the School of Natural Resources, conducts research in microclimatology. There is also considerable interest in the ever-present problem of fire control. The Department makes use of three wooded tracts of land within twenty miles of Ann Arbor, a large summer camp near Iron Mountain, in Michigan's Upper Peninsula, and the University's Biological Station, near Pellston, Michigan.



## VI. THE COMMUNITY OF ANN ARBOR

Ann Arbor has maintained a high socio-economic level in spite of rapid growth in recent years. It is a city that is planning for its future as the "Research Center of the Midwest."

### A. LOCATION AND GROWTH

Ann Arbor is the largest city in, and the County seat of, Washtenaw County. Wayne County (Detroit) lies directly east and is contiguous.

#### DISTANCE TO MAJOR CITIES

<u>Michigan</u>	<u>Miles</u>	<u>Out of State</u>	<u>Miles</u>
Battle Creek	76	Chicago	233
Benton Harbor	146	Cleveland	165
Detroit	37	Indianapolis	273
Grand Rapids	125	New York	665
Jackson	36	St. Louis	480
Kalamazoo	98	Toledo	53
Lansing	62	Washington, D.C.	514
Muskegon	164		

The City has increased its area through annexation by 120% since 1946. Thus city utilities have become available to thousands of homes that were formerly without them. The present size of the city is 14 square miles.

#### POPULATION GROWTH

	<u>1950</u> <u>Census</u>	<u>Estimate</u>		<u>Estimate</u>	
		<u>1957</u>	<u>1958</u>	<u>1970</u>	<u>1980</u>
Ann Arbor	48,251	64,500	67,000	78,000	86,500
Washtenaw County	134,606	163,000	169,000	230,000	293,000

B. UTILITIES

1. Water

Water is obtained from four pumping stations with an average capacity of 7,813,000 gallons per day. The water sources are wells (34%) and the Huron River (66%). The Water Treatment Plant, with a rated capacity of 17,000,000 gallons per day, purifies and softens the water.

The minimum water rate is \$2.75 per quarter. Gross metered rates are as follows:

	<u>Cubic Feet</u>	<u>Per 1000 Cubic Feet</u>
First	1,500	28.4¢
Next	23,000	17.3¢
Next	475,000	15.6¢
Next	500,000	13.7¢

2. Sewage Disposal

The Sewage Treatment plant is of the activated sludge type, with a designed capacity of 9,000,000 g.p.d., but capable of handling up to 12,000,000 g.p.d. for short periods. It is estimated that the present facility will take care of a population of 80,000.

The minimum rate is \$2.75 per quarter. The gross rate is 13.5¢ per 100 cubic feet of water plus a service charge based on meter size as follows:

<u>Meter Size</u>	<u>Per Quarter</u>
3/4"	\$ 2.50
1"	6.60
1-1/2"	16.60
2"	39.00
3"	72.00
4"	111.00
6"	250.00

### 3. Electricity

The Detroit Edison Company provides electric service in the Ann Arbor area. It serves a million and a quarter customers in 7,600 square miles in 13 counties in southeastern Michigan. It maintains a district office in Ann Arbor.

Energy is furnished mainly from six steam electric generating stations, located along the St. Clair and Detroit Rivers. The transmission system is interconnected with the generating facilities of the Consumers Power Company on the west and of the Ontario Hydro Commission on the east.

Service is available to commercial and industrial customers at both primary and secondary voltages, at rates determined by the nature of the service.

## C. CITY SERVICES

### 1. Police Protection

The Ann Arbor Police Department (staff of 94) is divided into five divisions: patrol, traffic, detective, youth, and communications. All 24 motor vehicles for police protection are equipped with 2-way radios. The department has six in-service training programs per year, and participates in two university training programs. The Chief and Deputy Chief are graduates of the FBI Police Academy.

### 2. Fire Protection

The Ann Arbor Fire Department operates two stations and one substation with a total of 65 men on a two-platoon system of 63-1/2 hours per week.

### 3. Zoning Laws and Building Codes

The City enacted its first zoning ordinance in 1923 and has attempted to

keep abreast of zoning advances by amending this basic document. In 1958 the Planning Commission began to draft a comprehensive rezoning ordinance for the City. This ordinance is now substantially complete and will be presented to the City Council for action in the very near future.

Some of the features included in the proposed ordinance are the prohibition of residential uses in industrial districts, the provision of two zones for research and office uses, modern standards of lot size, open-space and off-street parking, as well as an adequate amount of suitable land for residential, commercial, research, and industrial uses. It is felt that the proposed ordinance is a rational approach to shape the future growth and development of Ann Arbor and make it an even more attractive city in which to live.

The Department of Building and Safety Engineering administers the building, plumbing, electrical, heating, and housing codes. This department is under the supervision of a registered professional engineer. Ten inspections are made during new construction and at least two inspections before any remodeling is approved.

#### D. ASSESSED EVALUATION AND TAXES

The assessed valuation for the year 1959 was:

Real Property	\$ 83,916,980
Personal Property (business and industry only)	<u>17,963,970</u>
Total	<u><u>\$101,880,950</u></u>

The tax rate for 1959 was \$62.65 per \$1,000 of assessed valuation; assessed valuation is 75% of 1941 costs.

## E. HOUSING

During the last several years residential construction has so increased that it is now considered adequate to take care of the area's population growth for from three to five years. And new construction is still going on, or is being planned, noticeably in the vicinity of the University's North Campus.

### 1. Apartment Rentals

Apartments of all kinds and in all price ranges are readily available in Ann Arbor. Rents for older apartment units start at approximately \$80.00 per month; those for new units at approximately \$90.00 per month. Most new one-bedroom units average around \$100.00 per month plus utilities.

### 2. House Rentals

Houses for rent are more plentiful today than at any time since World War II. Most houses available are older homes, and the monthly rental averages about \$150.00 per month for a typical three-bedroom house.

### 3. Home Purchases

Older homes are readily available in all parts of the city. Most of the recently built houses are situated closer to the city's periphery. Prices for these new homes vary from about \$15,000 for a small 3-bedroom frame house to around \$21,000 for an average-size 3-bedroom brick-veneer house. A multiple listing service offered by the Ann Arbor Board of Realtors permits the buyer to deal with the realtor of his choice for all listings made through the Board.

### 4. Hotels-Motels

Ann Arbor has two hotels with approximately 120 rooms and six motels with

approximately 200 rooms.

5. Michigan Union—Michigan League

Anyone associated with University activities can obtain accommodations at the Michigan Union and under some conditions at the Michigan League.

F. MEDICAL SERVICES

1. St. Joseph Mercy Hospital (499 beds)

This hospital is sponsored by the Sisters of Mercy. Its services and facilities are made available to the private practitioners of Ann Arbor. It maintains a twenty-four-hour emergency service, with all types of specialists available. It sponsors a large variety of outpatient clinics on a fee basis.

2. University Medical Center (1047 beds)

This is one of the foremost medical centers in the Midwest. It is primarily a "referral" hospital, that is, patients are referred to it by their private physicians. Senior faculty members of the University Medical School have private practice privileges in the Hospital.

The Outpatient Clinic of the Medical Center is open from 8:00 - 5:00 every week day. Emergency Service, located in the Outpatient Building, is open around the clock. The Poison Control Center, located in the Emergency suite at the University Medical Center, provides instant references for cases of poisoning or suspected poisoning.

Other nearby medical facilities include the Mercywood Sanitarium (135 beds), and the U. S. Veterans Administration Hospital (485 beds).



G. RECREATION

1. City Park Lands

The recreation areas and their acreage is shown in the following tabulation:

	<u>No. of Acres</u>
6 Major Parks	171.85
6 Neighborhood Parks	43.55
10 Playgrounds	36.25
4 Play Lots	4.80
7 Landscaped Areas	128.50
2 Natural and Scenic Areas	<u>26.00</u>
Total	410.95

2. Recreation Program

A twelve-month recreation program is provided jointly by the City of Ann Arbor and the Public Schools. The 1958-59 ice skating season enjoyed 63 days of supervised skating. The eight-week summer play program is undertaken in sixteen different locations throughout Ann Arbor. In addition, there is a twenty-team city softball league and a seventy-four-team ball program for boys.

3. The Huron-Clinton Metropolitan Authority

This Authority, comprising Livingston, Oakland, Washtenaw, and Wayne Counties, is an agency made possible by a vote of the people in 1940 for the purpose of providing parks, parkways, and other recreation facilities along the valleys of the Huron and Clinton Rivers. Six such parks and several miles of parkways are already in operation. A seventh major area, now being acquired, will be open for public use in 1962.

4. State Parks and Recreation Areas

Within a thirty-mile radius of Ann Arbor are six State Parks with 1,121

acres of land, and four State Recreation areas with 33,129 acres of land. These facilities offer camping, picnicking, water sports, and hiking.

The State of Michigan is noted for its fine hunting, fishing, and other recreational activities. Thirty-two parks and recreational areas are under State control.

#### 5. The University Athletic Plant

About one-half mile southwest of the Central Campus of the University are the athletic buildings and fields. These include the Michigan Stadium (101,000 seats); the Sports Building, for intramural sports; the Yost Fieldhouse, for intercollegiate basketball and indoor track; the Coliseum, for ice skating and hockey; and the Varsity Pool Building. Surrounding these buildings are fields and courts for men's sports. Most of these recreational facilities are available to University staff members and to the personnel of University-associated activities.

#### 6. Golf

In and around Ann Arbor are two municipal courses and four privately owned courses, including the University Golf Course.

### H. EDUCATION

#### 1. Public Schools

Of the 25 schools listed below, 16 have been built in the last 16 years. The average classroom teacher—pupil ratio is 1 to 26.

PHYSICAL PLANT AND TEACHER--PUPIL RATIOS IN ANN ARBOR

<u>School</u>	<u>Built</u>	<u>Classroom Teachers</u>	<u>Students</u>
Northwest Jr. High	1960	Open in September, 1960	
Wines	1957	19	656
Pattengill	1957	20	604
Dicken	1957	18	512
High School	1956	85	1998
Disboro	1956	4	85
Haisley	1954	21	705
Meadowview	1953	4	99
Carpenter	1952	8	200
Mary D. Mitchell	1952	9	213
Sullivan	1951	3	55
Tappan Jr. High	1950	54	1157
Eberwhite	1950	19	552
Fritz	1949	3	77
Stone	1947	8	244
Pittsfield	1944	7	187
Northside	1937	17	507
Slauson Jr. High	1934	54	1224
Burns Park	1924	22	672
Angell	1922	13	416
Jones	1922	9	230
Mack	1922	18	494
Perry	1909	8	176
Wagner	1900	3	61
Bach	1859	13	359

TOTAL ENROLLMENT AND FACULTY

<u>Total Enrollment</u>		<u>Classroom Teachers</u>	
Elementary	7,030	Elementary	241
Junior High	2,381	Junior High	108
Senior High	<u>1,998</u>	Senior High	<u>85</u>
Total	11,409	Total	434

In addition to classroom teachers, the Ann Arbor Public School System employs 34 special teachers for art, physical education, music, and foreign languages, and 70 administrators, supervisors, health staff, library, and central office personnel.

The following special programs are administered by the Public Schools:

Speech Correction and Homebound  
 Advanced Placement (secondary level)  
 Academic Summer School (grades 7-12)  
 Apprentice Training—Vocational Education  
 Cooperative Training Program with Industry  
 Practical Nurses Training Center  
 Adult Education Evening School  
 Twelve-Month Recreation Program

## 2. University Schools

These schools are laboratory schools operated by the School of Education of The University of Michigan.

Elementary (Nursery - 6)	built in 1929	10 teachers	197 students
High school (7 - 12)	built in 1924	45 teachers	338 students

## 3. Parochial Schools

	<u>Built</u>	<u>Teachers</u>	<u>Students</u>
St. Francis Elementary (Roman Catholic)	1952	8	320
St. Thomas Elementary (Roman Catholic)	1955	14	616
St. Thomas High (Roman Catholic)	1930	11	350
Redeemer Elementary (Lutheran)	1946	1	19
Seventh Day Adventist	1953	2	30

## I. CHURCHES

African Methodist Episcopal, Bethel	Christian Reformed, Ann Arbor Church
Baptist, First	Campus Chapel (Christian Reformed)
Baptist, Harmony Missionary	Christian Science, First Church
Baptist, Second	Church of Christ
Baptist, North Side	Church of Jesus Christ of Latter Day Saints
Beth Israel Community Center	
B'nai B'rith Hillel Foundation	Church of the Nazarene, First
Catholic, St. Francis of Assisi	Congregational, First
Catholic, St. Mary's Student Chapel	Apostolic Church, First
Catholic, St. Thomas	Episcopal, St. Andrew's
	Episcopal (mission), St. Clare of Assisi

Evangelical and Reformed, Bethlehem Church of the Good Shepherd	Lutheran, Darlington Evangelical (Wisconsin)
Evangel Temple, Assembly of God	Disciples of Christ (Christian Memorial)
Evangelical United Brethren	Methodist, First
Emmanuel Baptist Church, Free Methodist	Methodist, West Side
Friends Meeting (Quakers), Friends Center	Pentecostal Church of God
Grace Bible	Pentecostal, Bethlehem
Greek Orthodox, St. Nicholas	Pilgrim Holiness
Lower Light	Presbyterian, First
Lutheran, Redeemer	Presbyterian, Westminster of Ann Arbor
Lutheran, St. Paul's Evangelical	Presbyterian, Calvary Community
Lutheran, Trinity Evangelical	Reformed Church, Ann Arbor
Lutheran, Peace Evangelical (ULCA)	Reorganized Church of Jesus Christ of Latter Day Saints
Lutheran, University Chapel	Salvation Army
St. Luke's Lutheran Church	Seventh Day Adventist
Lutheran, Zion Evangelical	Unitarian, First
Lutheran Student Center and Chapel	Unity Center of Practical Christianity

J. CULTURAL ADVANTAGES

1. Libraries

Ann Arbor Public Library (\$728,000 building, opened 1957)

The University of Michigan libraries were discussed in Part II, Section F.

2. Music

(a) Community-sponsored:

Ann Arbor Civic Symphony Orchestra  
 Ann Arbor Civic Band  
 Public School May Festival  
 Public School Bands  
 Christmas Community Sing

(b) University-sponsored:

Choral Union Series - 10 concerts  
 Extra Concert Series - 5 concerts  
 Handel's Messiah - 2 performances  
 Chamber Music Festival - 3 concerts  
 May Festival - 6 concerts  
 University Choral Union  
 Musical Society Orchestra  
 University Symphony Orchestra - 2 to 3 concerts

University Symphony Band  
University Choirs  
Stanley Quartet - 5 concerts  
School of Music—Department of Speech Operas  
Gilbert and Sullivan Society - 2 operettas  
University Glee Club  
Organ Recitals - 6 recitals  
Carillon Concerts  
Faculty Recitals  
Student Recitals

3. Drama

- (a) Community-sponsored:  
Ann Arbor Civic Theater
- (b) University-sponsored:  
Department of Speech Playbill

4. Art

Ann Arbor Art Association  
Potter's Guild  
Museum of Art (The University of Michigan)  
Student Art Exhibit

5. Dance

Ann Arbor Civic Ballet

6. Lectures and Educational Films

World Travel and Adventure Series  
Audubon Screen Tours  
Oratorical Association Lecture Course (The University of Michigan)  
University Lectures (The University of Michigan)  
Assemblies (The University of Michigan)

7. Museums and Exhibits

There are six University museums, all open to the public.

## VII. TEMPORARY AND/OR SUPPLEMENTARY SITE

The University of Michigan recognizes that the University Corporation for Atmospheric Research may wish to consider using temporary headquarters while permanent headquarters are under construction. The University offers the use of its research facilities at the Willow Run Airport as a possible temporary site.

The University has submitted an application to the Federal Government for permanent ownership of Air Force Station P23, more commonly known as the Thirtieth Air Division Base, for research purposes. This Air Force facility is immediately adjacent to The University of Michigan's Willow Run Airport and comprises 135 acres of land, on which there are twenty buildings, with 90,000 square feet of space, aside from utility installations. These buildings are ideally suited to research purposes. Map No. 11 shows the location of this facility in relation to The University of Michigan Willow Run Airport and the University of Michigan research facilities located on this property. Map No. 12 shows the location of buildings, the use for which they were designed, and the road system. An aerial photo of the area is also included (Map No. 13).

In addition to applying for title to this property, the University has also requested a three-year lease. Arrangements could therefore be made with the University Corporation for Atmospheric Research for the temporary use of this site or as a site supplementary to the North Campus area.





TABLE I

## AIRLINES SERVING THE DETROIT AREA AND FREQUENCY OF FLIGHTS PER DAY

## Willow Run Airport

<u>Airlines</u>	<u>Arrivals</u>	<u>Departures</u>
*Capital Airlines	72	72
*Eastern Air Lines	40	39
Lake Central Airlines	2	2
Mohawk Airlines	4	5
North Central Airlines	14	15
*Trans World Airlines	11	9
*United Air Lines	11	11

## Detroit Metropolitan Airport

<u>Airlines</u>	<u>Arrivals</u>	<u>Departures</u>
Allegheny Airlines	4	4
*American Airlines	104	107
*British Overseas Airways (International)	4	4
*Delta Air Lines	26	29
*Northwest Orient Airlines	19	18
*Pan American (International)	4	4
*Trans-Canada Air Lines	8	8

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\*Trunk Carriers (Local Service Carriers unmarked).

TABLE II

RAILROAD PASSENGER SERVICE  
 Detroit, Michigan - January, 1960

Railroad	Principal Cities Directly Served	No. of Departures (Daily)
B and O	Pittsburgh—Washington—Baltimore	1
B and O	Cincinnati—Louisville	2
C and O	Columbus—Charleston—Norfolk	1
C and O	Lansing—Grand Rapids	2
New York Central	Chicago (also serves Ann Arbor)	5
New York Central	Buffalo—New York City	3
New York Central	Boston	1
New York Central	Cleveland	1
New York Central	Saginaw—Bay City—Mackinaw	1
Grand Trunk	Chicago (via Durand)	2
Canadian National	Toronto—Montreal (via Windsor)	2
Canadian Pacific	Toronto—Montreal	3

Note: New York Central also serves Ann Arbor with 5 daily departures East to Detroit, and West to Jackson, Battle Creek, Kalamazoo, and Chicago.

TABLE III

## RADIO TRANSMITTER FREQUENCIES

Site No.	Location	Frequency	Power	Antenna
<u>Within 10- and 20-mile radius of Willow Run Airport</u>				
1	Willow Run Airport	332 Kc	15 W	ND*
		359 Kc	50 W	ND
		1191 Kc	5 W	ND
		109.5 Mc	30 W	ND
		114.4 Mc	35 W	ND
		118.4 Mc	35 W	ND
		121.3 Mc	35 W	ND
		121.5 Mc	35 W	ND
		121.9 Mc	35 W	ND
		123.7 Mc	35 W	ND
		124.9 Mc	35 W	ND
		142.7 <sup>4</sup> Mc	100 W	ND
		243.0 Mc	100 W	ND
		257.8 Mc	100 W	ND
		263.0 Mc	100 W	ND
		285.4 Mc	100 W	ND
		290.3 Mc	100 W	ND
		332 Mc	7 W	Main lobe 230° true
		335.8 Mc	100 W	ND
		2798 Mc	500 Kw	ND
9067 Mc	35 Kw	ND		
2	Wayne Major Airport	212 Kc	10 W	ND
		243 Kc	5 W	ND
		257 Kc	100 W	ND
		375 Kc	100 W	ND
		388 Kc	100 W	ND
		109.3 Mc	40 W	Main lobe 212°
		118.8 Mc	40 W	ND
		119.8 Mc	40 W	ND
		120.3 Mc	40 W	ND
		120.4 Mc	40 W	ND
		120.7 Mc	40 W	ND
		121.1 Mc	40 W	ND
		121.5 Mc	40 W	ND
		121.7 Mc	40 W	ND
		122.2 Mc	40 W	ND
		122.7 Mc	40 W	ND

\*ND - Nondirectional

TABLE III (Continued)

Site No.	Location	Frequency	Power	Antenna
2 (Concluded)	Wayne Major Airport	123.9 Mc	40 W	ND
		124.5 Mc	40 W	ND
		125.3 Mc	40 W	ND
		125.6 Mc	40 W	ND
		126.1 Mc	40 W	ND
		126.18 Mc	40 W	ND
		126.4 Mc	40 W	ND
		126.7 Mc	40 W	ND
		240.0 Mc	80 W	ND
		243.0 Mc	80 W	ND
		255.4 Mc	80 W	ND
		257.8 Mc	80 W	ND
		269.2 Mc	80 W	ND
		269.6 Mc	80 W	ND
		272.7 Mc	80 W	ND
		301.4 Mc	80 W	ND
		317.5 Mc	80 W	ND
		332.0 Mc	50 W	Main lobe 212°
		335.6 Mc	80 W	ND
		335.9 Mc	80 W	ND
		343.8 Mc	80 W	ND
		351.9 Mc	80 W	ND
		354.1 Mc	80 W	ND
		360.7 Mc	80 W	ND
		363.0 Mc	80 W	ND
		1280.0 Mc	380 Kw	ND
		1315.0 Mc	380 Kw	ND
7200.0 Mc	20 W	Main lobe 300° true		
7500.0 Mc	20 W	Main lobe 300° true		
319.9 Mc	80 W	ND		
3	The U-M Campus	33.14 Mc	3 W	ND
		35.94 Mc	500 W	ND
		950.0 Mc	20 W	Main lobe 317° true
4	Ann Arbor	1050 Kc	1000 W	ND
		37.10 Mc	60 W	ND
		37.34 Mc	60 W	ND
		48.18 Mc	60 W	ND
		152.33 Mc	60 W	ND
		152.39 Mc	60 W	ND
		153.53 Mc	60 W	ND
		157.59 Mc	60 W	ND
		157.65 Mc	60 W	ND

TABLE III (Concluded)

Site No.	Location	Frequency	Power	Antenna
5	Salem	117.8 Mc	100 W	ND
6	Carleton	113.8 Mc	100 W	ND
7	Trenton	760.0 Kc	50,000 W	ND
8	Grosse Ile	269 Kc	100 W	ND
		414 Kc	100 W	ND
		39.02 Mc	60 W	ND
9	Dearborn	1270.0 Kc	5 Kw	ND
		1310.0 Kc	5 Kw	ND
		100.3 Mc	7.1 Kw	ND
		101.1 Mc	14 Kw	ND
		101.9 Mc	52 Kw	ND
		153.83 Mc	60 W	ND
		154.77 Mc	60 W	ND
		155.37 Mc	60 W	ND
		156.15 Mc	60 W	ND
158.85 Mc	60 W	ND		
10	Allen Park	155.37 Mc	60 W	ND
		155.49 Mc	60 W	ND
11	Ypsilanti	1600.0 Kc	1 Kw	ND
		42.58 Mc	60 W	ND
		42.78 Mc	60 W	ND
		152.27 Mc	60 W	ND
		152.39 Mc	60 W	ND
		152.45 Mc	60 W	ND
		154.09 Mc	60 W	ND
		154.37 Mc	60 W	ND
		155.13 Mc	60 W	ND
		155.37 Mc	60 W	ND
		157.53 Mc	60 W	ND
		157.65 Mc	60 W	ND
		157.71 Mc	60 W	ND
<u>Within 10- and 20-mile radius of U-M North Campus</u>				
1-6	Same as from Willow Run Airport			
7	Dexter	91.7 Mc	10 Kw	ND
8	Ypsilanti - Same as from Willow Run Airport			

TABLE IV

CLIMATOLOGICAL DATA FOR ANN ARBOR AREA

Normals, Means, and Extremes

Latitude 42° 14' N

Longitude 83° 32' W

Elevation (ground) 722 feet

Month (a)	Temperature								Normal degree days (b)	Precipitation										
	Normal			Extremes						Normal total (b)	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hr	Year	Snow, Sleet			
	Daily maximum (b)	Daily minimum (b)	Monthly (b)	Record highest	Year	Record lowest	Year	Mean total									Maximum monthly	Year	Maximum in 24 hr	Year
J	32.1	18.5	25.3	69	1950	- 8	1948	1231	1.80	4.17	1950	.59	1958	1.33	1952	8.4	15.5	1957	7.0	1957
F	33.5	18.7	26.1	65	1957+	- 7	1958+	1089	1.74	4.31	1954	.44	1958	2.08	1954	6.2	12.7	1950	5.8	1950
M	43.7	27.2	35.5	73	1949	0	1948	915	2.35	4.39	1954	.30	1958	2.35	1954	5.6	15.0	1954	7.2	1956
A	56.8	36.4	46.6	85	1948	14	1954	552	2.94	6.73	1947	1.96	1958	2.50	1947	1.1	3.9	1957	2.9	1957
M	69.5	46.9	58.2	92	1953+	29	1947	244	3.44	6.95	1947	1.18	1958	1.43	1950+	T	T	1954+	T	1954+
J	79.7	57.5	68.6	100	1953	39	1949	55	3.26	4.87	1956	1.55	1952	3.13	1956	.0	.0		.0	
J	84.3	62.6	73.5	100	1955	48	1950	0	2.49	4.85	1951	1.62	1954	3.17	1951	.0	.0		.0	
A	81.2	61.0	71.1	99	1955+	43	1950	10	2.71	8.71	1947	1.15	1954	4.78	1947	.0	.0		.0	
S	74.1	54.5	64.3	100	1954+	34	1956+	96	3.02	3.61	1947	.69	1956	1.78	1947	.0	.0		.0	
O	61.8	43.1	52.5	91	1951	25	1952	393	2.17	6.13	1954	.50	1953	2.98	1954	T	.2	1954	.2	1954
N	46.3	33.1	39.7	81	1950	2	1950	759	2.20	4.19	1948	.75	1953	2.02	1951	4.7	10.1	1951	8.0	1951
D	34.9	22.5	28.7	63	1951	- 9	1951	1125	2.04	3.95	1951	.44	1958	1.26	1950	7.1	25.1	1951	7.8	1951
Yr	58.2	40.2	49.2	100	July 1955+	- 9	Dec 1951	6469	30.16	8.71	Aug 1947	.30	Mar 1958	4.78	Aug 1947	33.1	25.1	Dec 1951	8.0	Nov 1951

Relative Humidity				Wind					Mean sky cover sunrise to sunset	Sunrise to Sunset				Mean Number of Days				Temperatures			
1:00 A.M. EST	7:00 A.M. EST	1:00 P.M. EST	7:00 P.M. EST	Mean hourly speed	Prevailing direction	Fastest Mile				Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, sleet 1.0 inch or more	Thunderstorms	Heavy fog	Maximum		Minimum		
						Speed	Direction	Year									90° and above	35° and below	30° and below	0° and below	
80	81	71	76	11.6	SW	55	SW	1949	7.7	4	7	20	12	3	*	4	0	14	29	1	
79	80	65	73	11.7	SW	40	W	1958+	7.3	4	7	17	10	3	*	3	0	10	26	1	
77	79	58	67	12.9	WNW	52	SW	1955	7.2	6	6	19	11	2	2	3	0	5	24	*	
76	77	51	59	12.2	SW	46	WNW	1958	6.9	6	6	18	13	*	4	2	0	*	9	0	
75	74	48	57	10.7	SW	60	W	1959	6.5	6	11	14	11	0	5	1	*	0	*	0	
78	77	49	57	9.4	SW	60	W	1951	6.2	6	12	12	10	0	6	1	5	0	0	0	
78	78	48	55	8.8	SW	55	W	1958	5.6	9	12	10	9	0	5	1	7	0	0	0	
81	83	49	60	8.3	SW	40	NNW	1958	5.3	9	13	9	9	0	5	1	6	0	0	0	
82	85	50	63	9.4	SW	52	WSW	1959	5.3	11	9	10	8	0	4	1	2	0	0	0	
81	85	52	66	9.7	SW	40	W	1949	5.5	11	7	13	8	0	2	3	*	0	3	0	
80	83	64	73	12.0	SW	51	WSW	1958	7.6	4	7	19	11	1	1	3	0	4	17	0	
80	81	69	76	11.4	SW	39	ESE	1950	7.7	4	7	20	11	2	*	4	0	10	26	1	
79	80	56	65	10.7	SW	60	W	May 1959+	6.6	80	104	181	123	11	34	27	20	43	134	3	

(a) Length of record, years.

(b) Normal values are based on the period 1921-1950, and are means adjusted to represent observations taken at the present standard location.

TABLE V  
BOUND VOLUMES IN UNIVERSITY LIBRARIES

Library	In Library June 30, 1959
Architecture	16,203
Astronomy	16,165
Biological Station	6,114
Bureau of Government	42,754
Business Administration	115,530
Chemistry (including Pharmacy)	24,766
Dentistry	18,798
Education	26,581
Engineering	130,194
Extension	8,783
Far Eastern	80,000
Fine Arts	12,562
Journalism	438
Lane Hall	1,852
Library Extension	8,695
Library Science	11,153
McMath-Hulbert Observatory	2,046
Mathematics	27,609
Medical	124,583
Museums	53,904
Music	13,857
Natural Science and Natural Resources	87,283
Phoenix	2,310
Physics	19,440
Public Health	12,169
Social Work	1,399
Statistical Research	404
Transportation	121,254
Undergraduate Library	68,590
Detroit Branch	8,012
General Library	1,258,210
Clements Library	36,949
Flint Library	19,336
Law Library	290,435
TOTAL	2,668,378

TABLE VI

ORIGIN OF STUDENTS BY SELECTED GEOGRAPHICAL REGIONS  
ACADEMIC YEAR, 1958-1959

Residence and Extramural Students in Credit and Postgraduate Professional Programs	Students	Percent
Michigan	26,994	69.60
Other States	9,339	24.08
Latin America	582	1.50
Far East	381	.98
South Asia	376	.97
Canada	368	.95
Near East	323	.83
British Isles and Europe	195	.50
United States Territories	157	.41
Africa	66	.17
Australia	<u>5</u>	<u>.01</u>
TOTAL	38,786	100.00

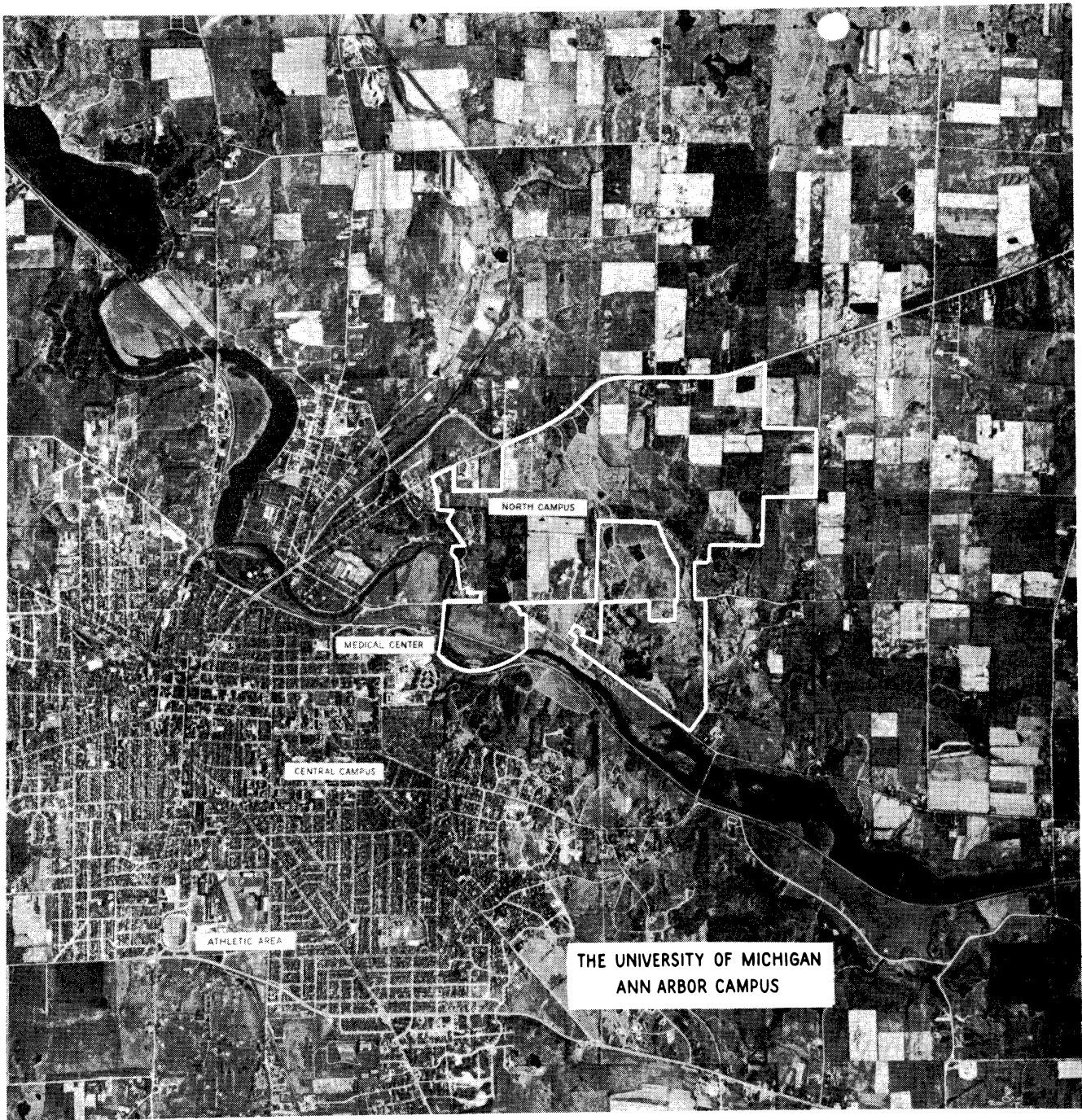


TABLE VII

REGIONAL DISTRIBUTION OF STUDENTS, 1958-1959  
RESIDENCE STUDENTS IN CREDIT PROGRAMS AND EXTRAMURAL STUDENTS IN  
CREDIT AND PROFESSIONAL PROGRAMS

Student Group	All Areas	United States			U. S. Territories	Foreign	
		Total	Mich-igan	Other States			
Residence Enrollment in First and Second Semester	Arch. and Design	706	676	471	205	7	23
	Business Admin	1,271	1,186	875	311	2	83
	Dentistry	481	472	446	26	1	8
	Education	1,191	1,162	882	280	7	22
	Engineering	3,555	3,176	2,426	750	20	359
	Flint	510	510	510	---	-	-
	Graduate	6,734	6,089	4,636	1,453	29	616
	Law	876	841	365	476	4	31
	LSA	8,189	7,599	5,080	2,519	38	552
	Medicine	1,314	1,253	1,028	225	6	55
	Music	560	555	307	248	1	4
	Natural Resources	205	188	85	103	3	14
	Nursing	701	698	492	206	2	1
	Pharmacy	161	151	113	38	1	9
	Public Health	214	173	85	88	2	39
	Social Work	270	262	210	52	1	7
Hospital Training	21	18	5	13	1	2	
Net total, first and second semesters		26,199	24,356	17,536	6,820	123	1,720
1958 summer session		10,781	9,794	6,610	3,184	50	937
Credit extension		6,696	6,640	6,418	222	2	54
Extramural medical and short post-graduate in medical, dentistry, or hospital training		1,732	1,648	1,185	463	2	82
Net total		38,786	36,333	26,994	9,339	157	2,296



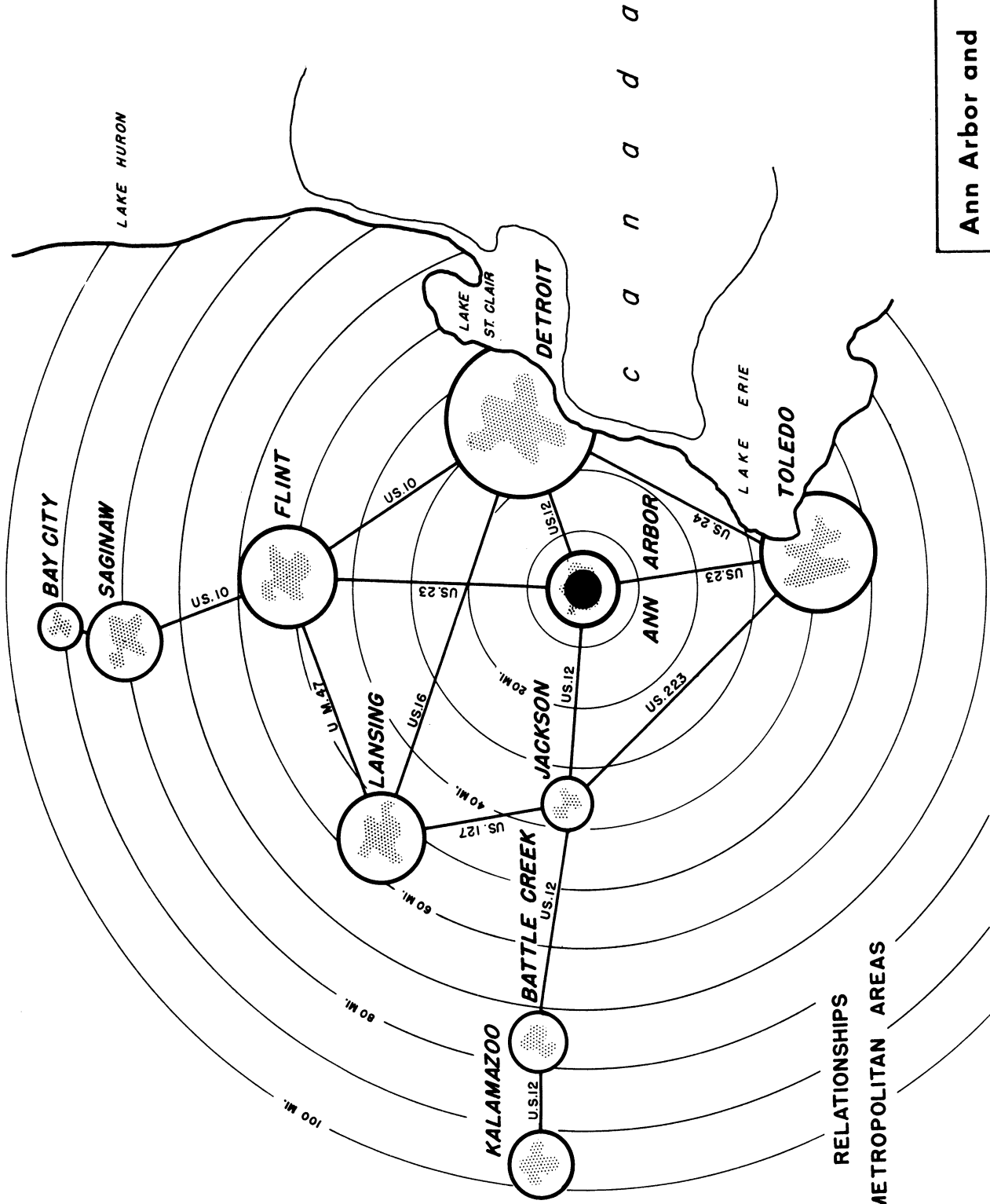


The North Campus area (outlined in white) presently consists of 826 acres.

Aerial View Showing  
North Campus Area

*Map No. 1*

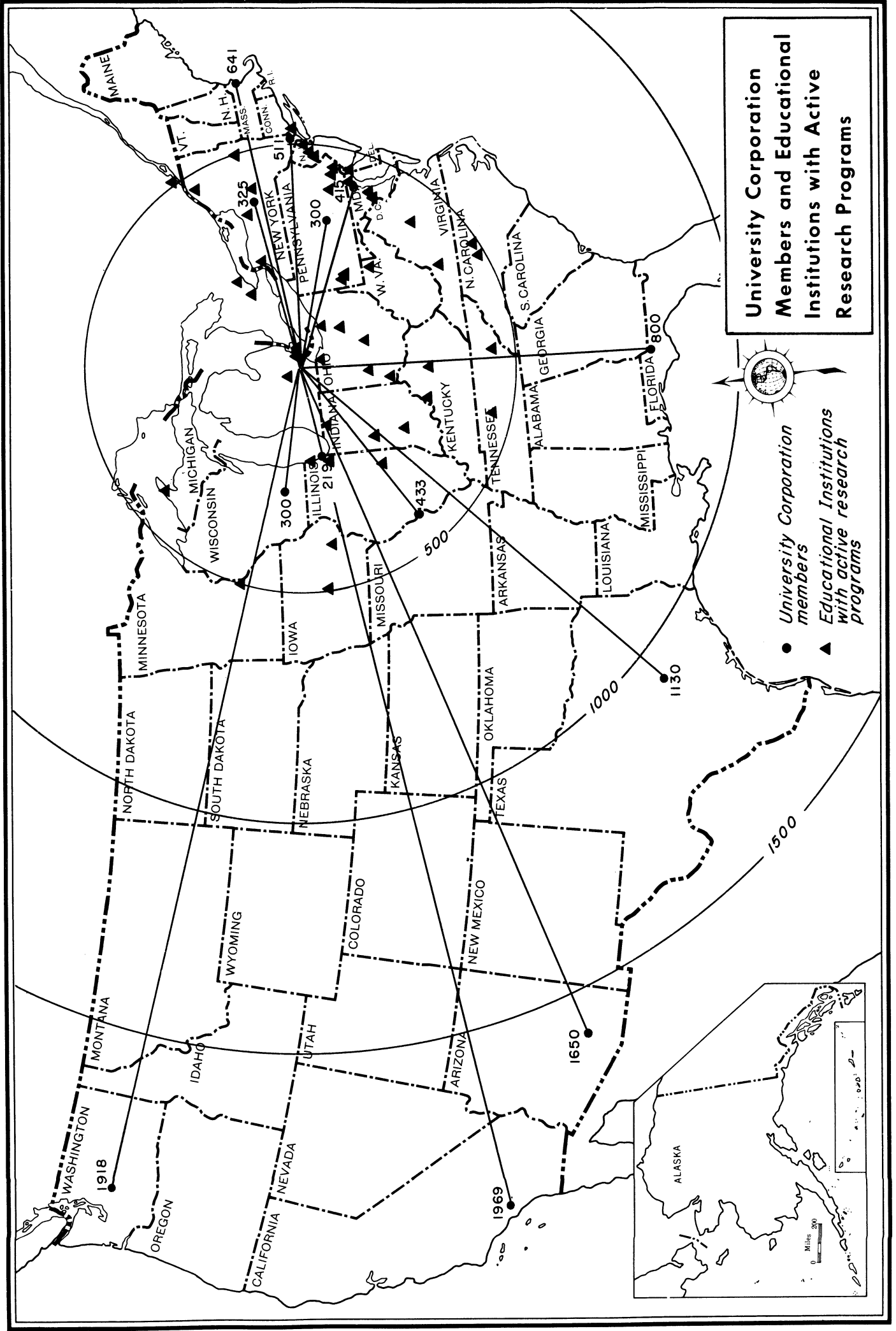




**DIAGRAMMATIC RELATIONSHIPS  
BETWEEN STANDARD METROPOLITAN AREAS**

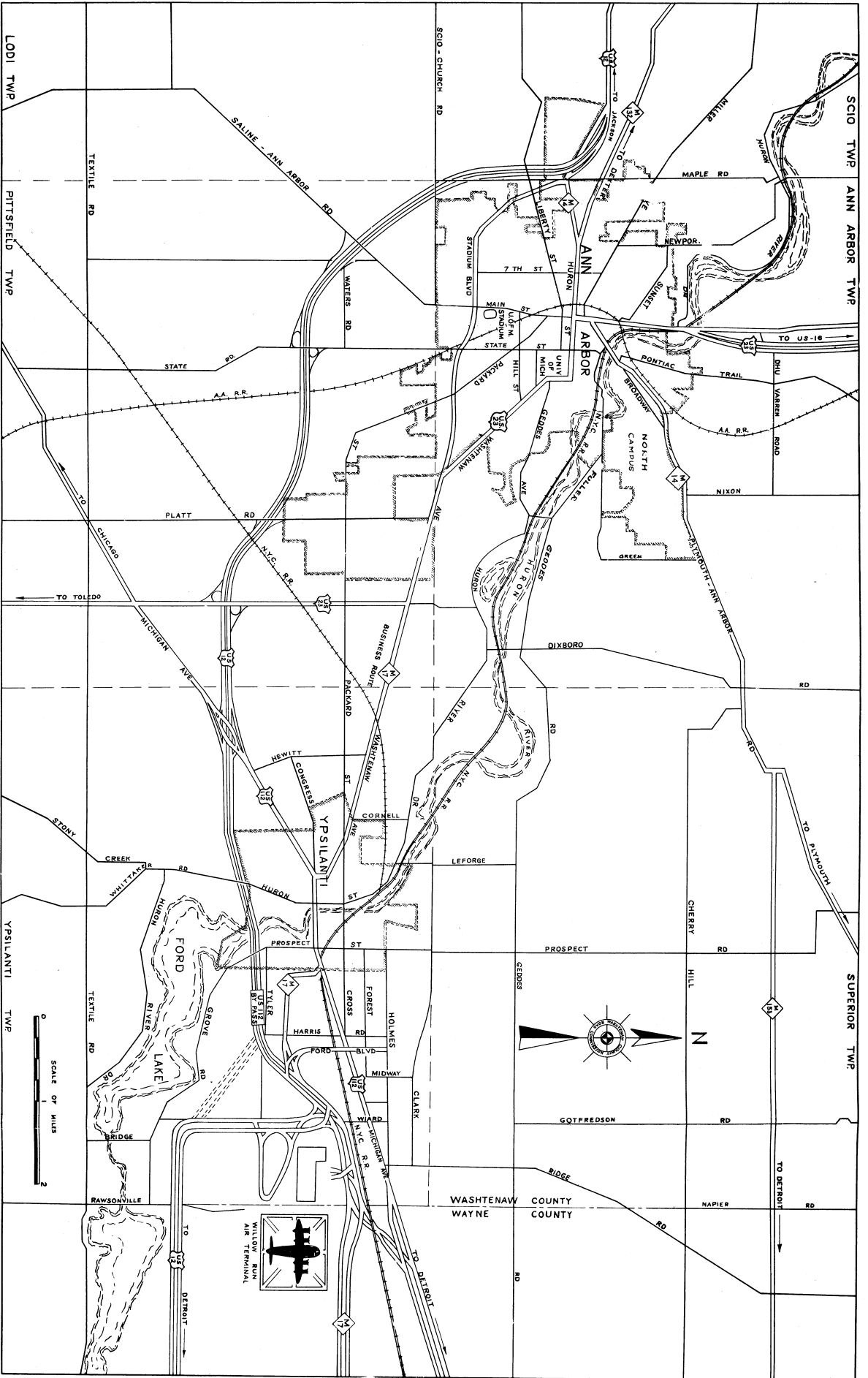
**Ann Arbor and  
Metropolitan Areas**





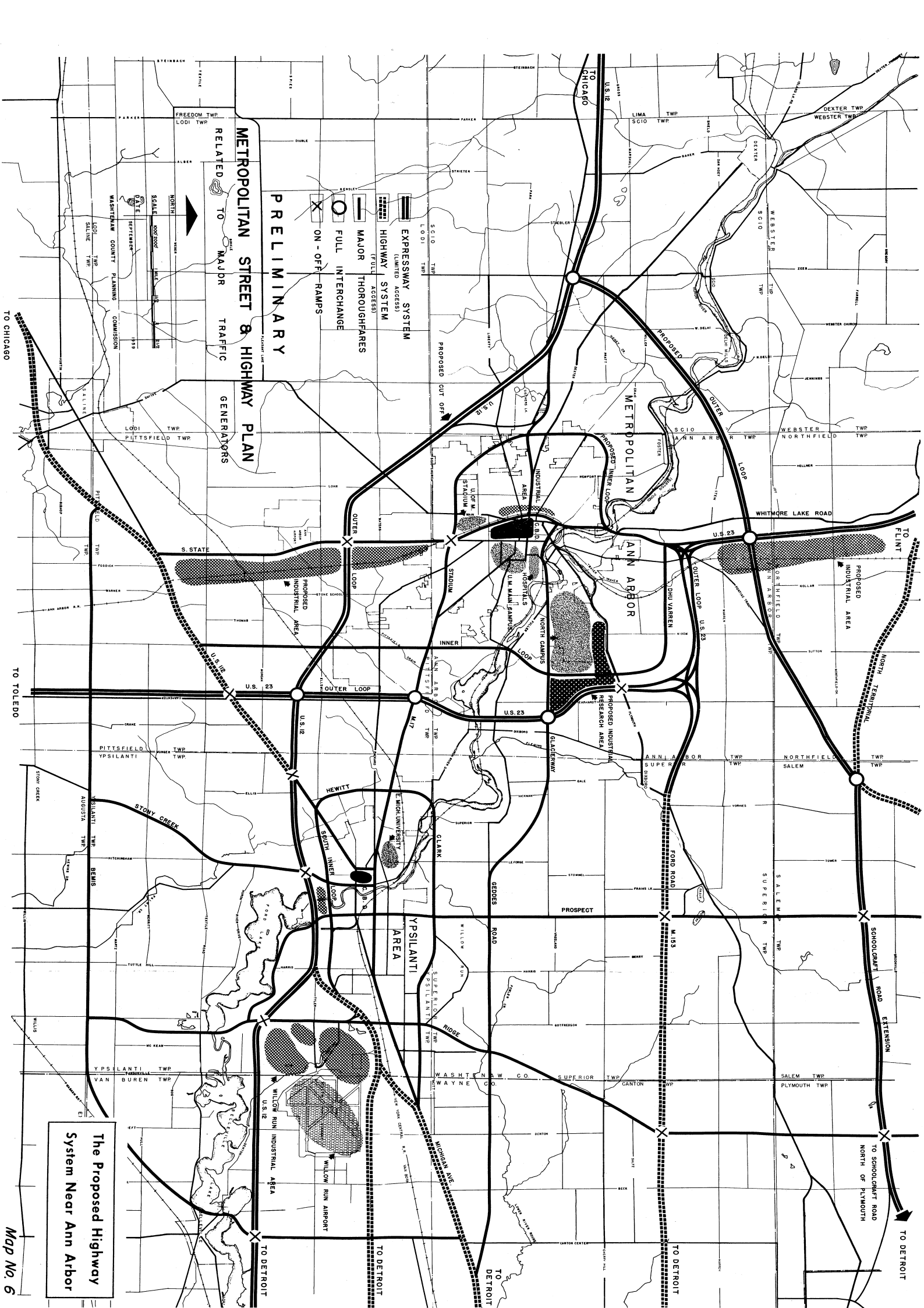






The Present Highway System Near Ann Arbor





- EXPRESSWAY SYSTEM (LIMITED ACCESS)
- HIGHWAY SYSTEM (FULL ACCESS)
- MAJOR THOROUGHFARES
- FULL INTERCHANGE
- ON - OFF RAMP

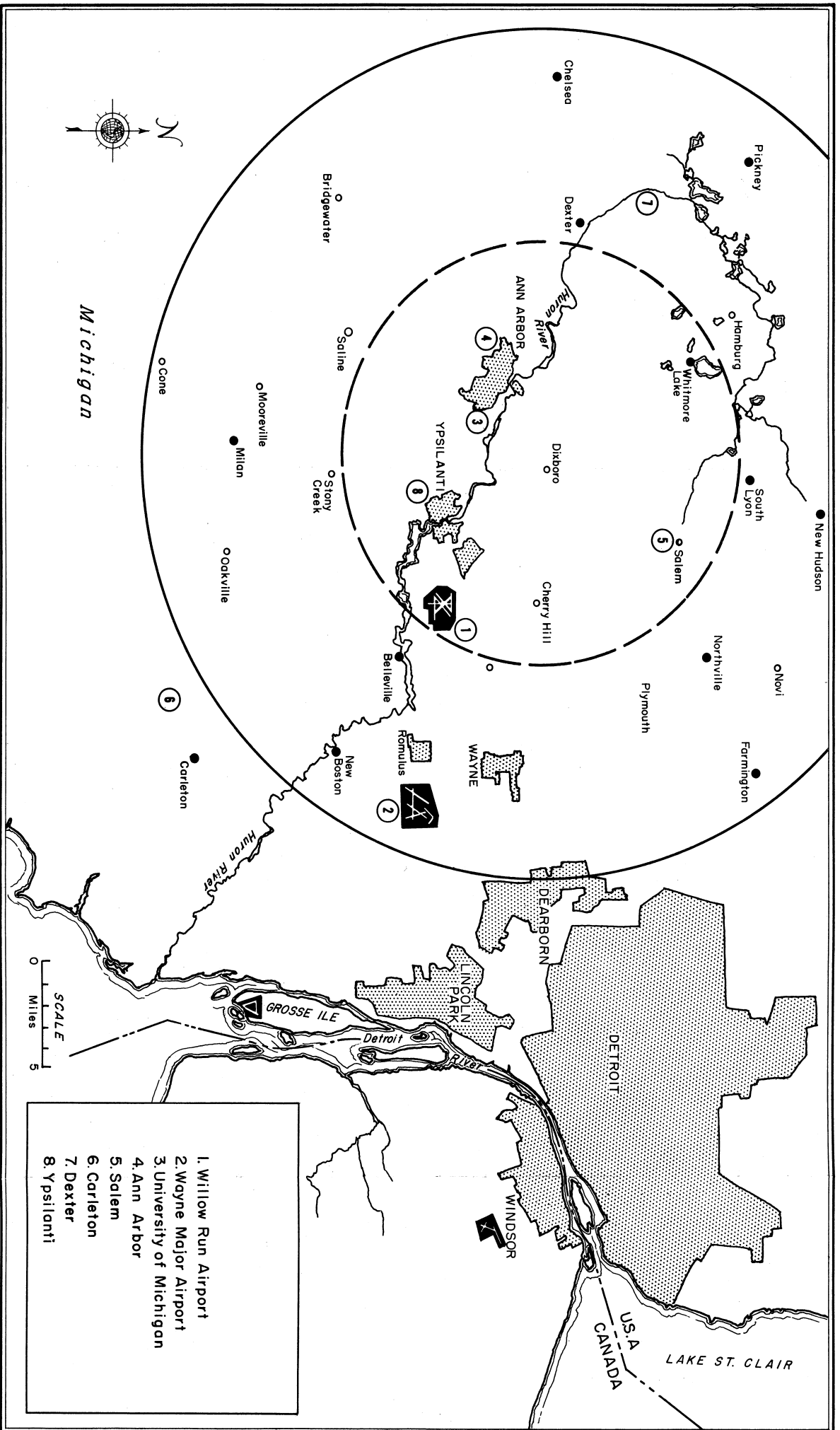
**PRELIMINARY**

**METROPOLITAN STREET & HIGHWAY PLAN**  
RELATED TO MAJOR TRAFFIC GENERATORS

SCALE: 1" = 1/4 MILE  
DATE: SEPTEMBER 1959  
WASHINGTON COUNTY PLANNING COMMISSION

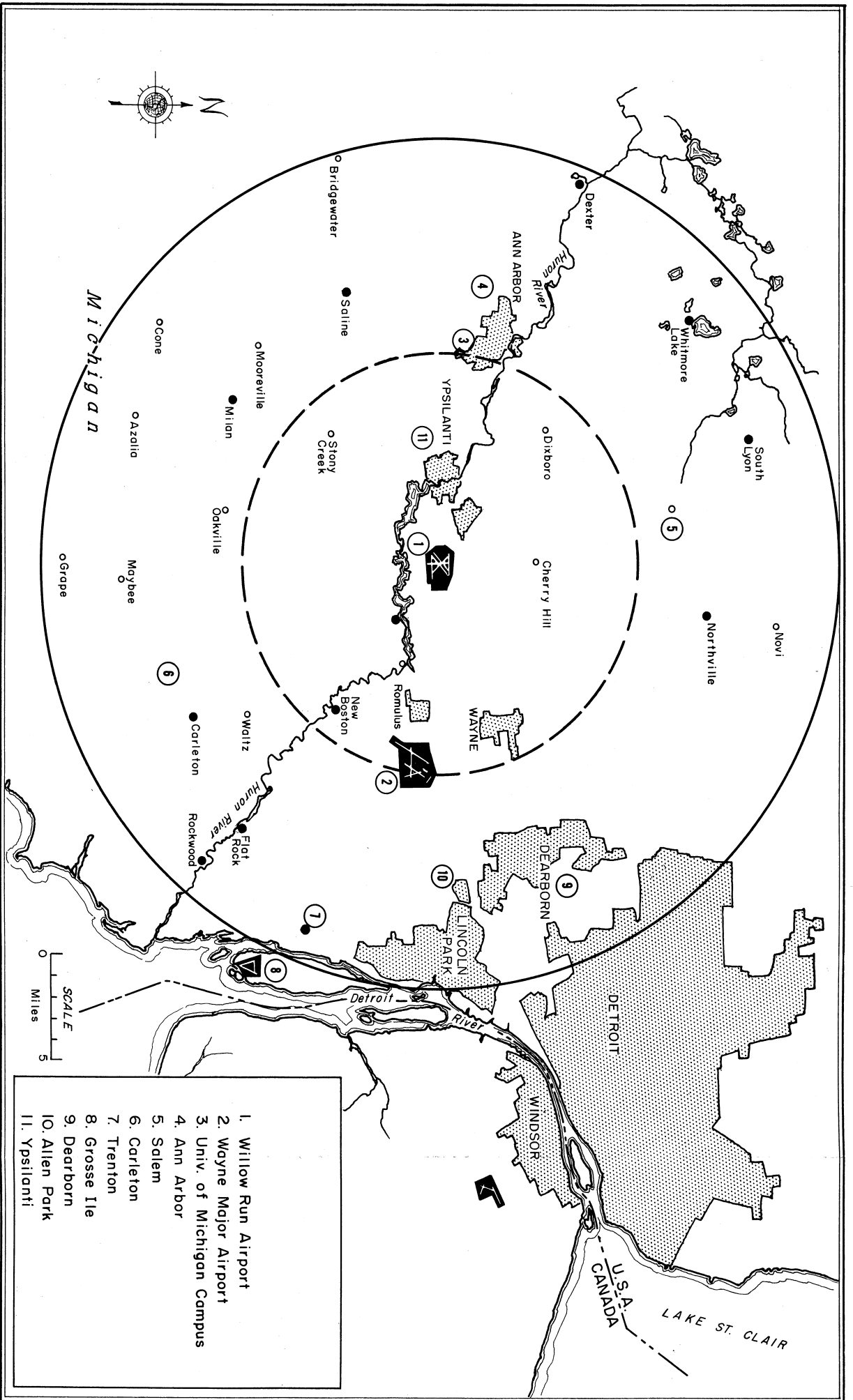
**The Proposed Highway System Near Ann Arbor**





**Radio Transmitting Equipment**  
**Within 20 Miles of North Campus**



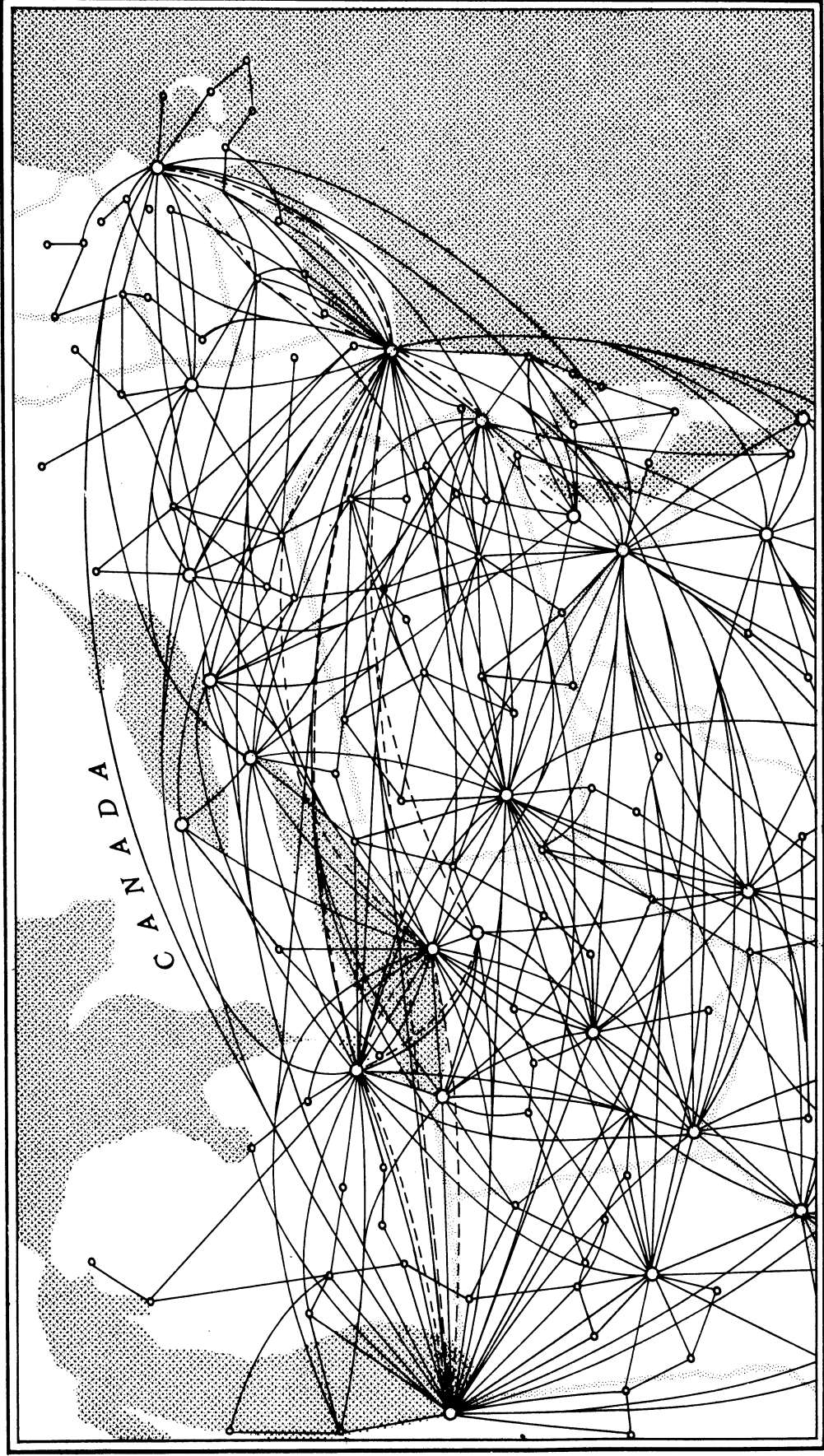


1. Willow Run Airport
2. Wayne Major Airport
3. Univ. of Michigan Campus
4. Ann Arbor
5. Salem
6. Carleton
7. Trenton
8. Grosse Ile
9. Dearborn
10. Allen Park
11. Ypsilanti

Radio Transmitting Equipment Within  
20 Miles of Willow Run Airport







**Flight Pattern of Scheduled Aircraft  
Serving Great Lakes Area**

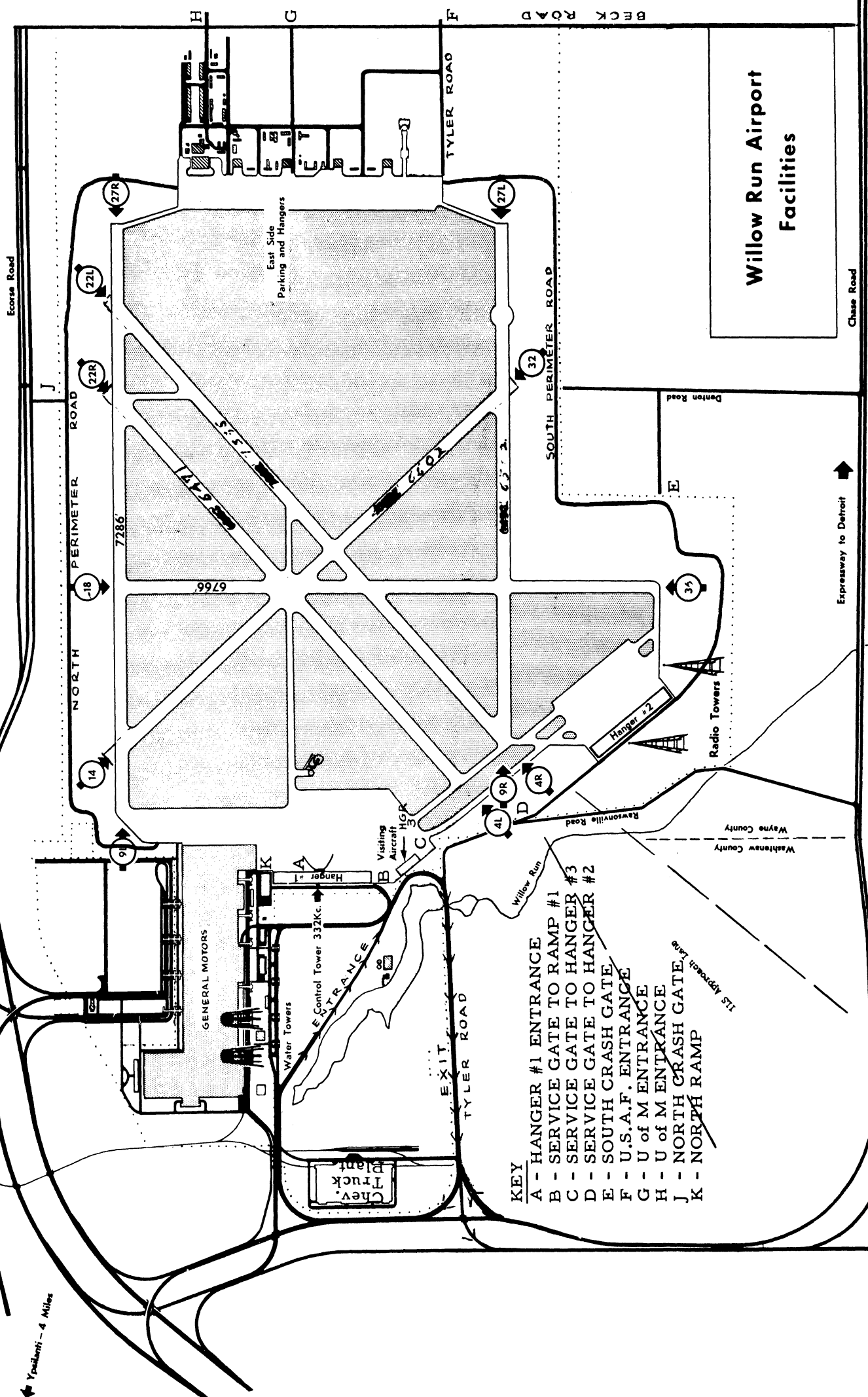
*Map No. 9*





Michigan Central Railroad

Ypsilanti - 4 Miles

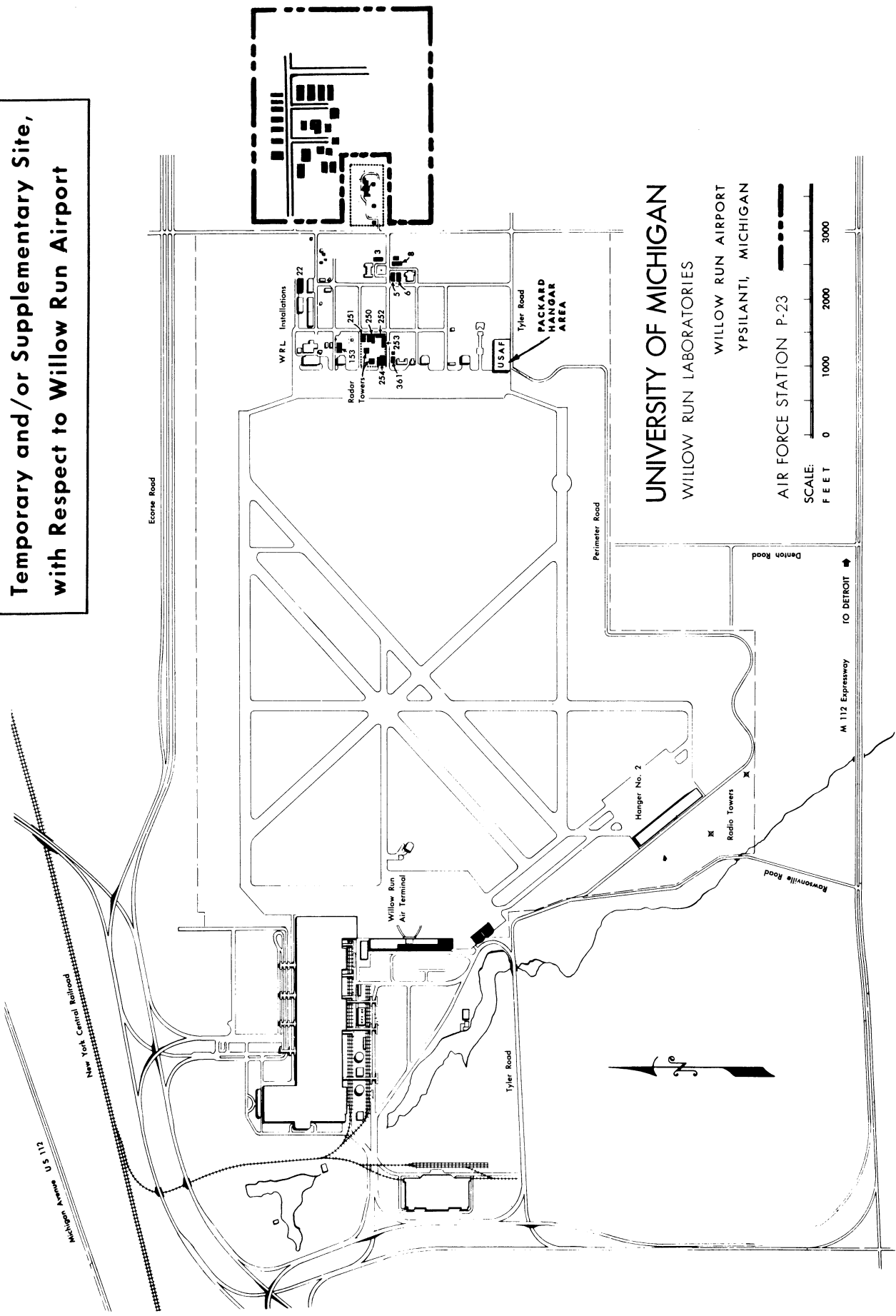


- KEY**
- A - HANGER #1 ENTRANCE
  - B - SERVICE GATE TO RAMP #1
  - C - SERVICE GATE TO HANGER #3
  - D - SERVICE GATE TO HANGER #2
  - E - SOUTH CRASH GATE
  - F - U.S.A.F. ENTRANCE
  - G - U of M ENTRANCE
  - H - U of M ENTRANCE
  - J - NORTH CRASH GATE
  - K - NORTH RAMP

**Willow Run Airport  
Facilities**



**Temporary and/or Supplementary Site,  
with Respect to Willow Run Airport**



**UNIVERSITY OF MICHIGAN**  
WILLOW RUN LABORATORIES

WILLOW RUN AIRPORT  
YPSILANTI, MICHIGAN

AIR FORCE STATION P-23

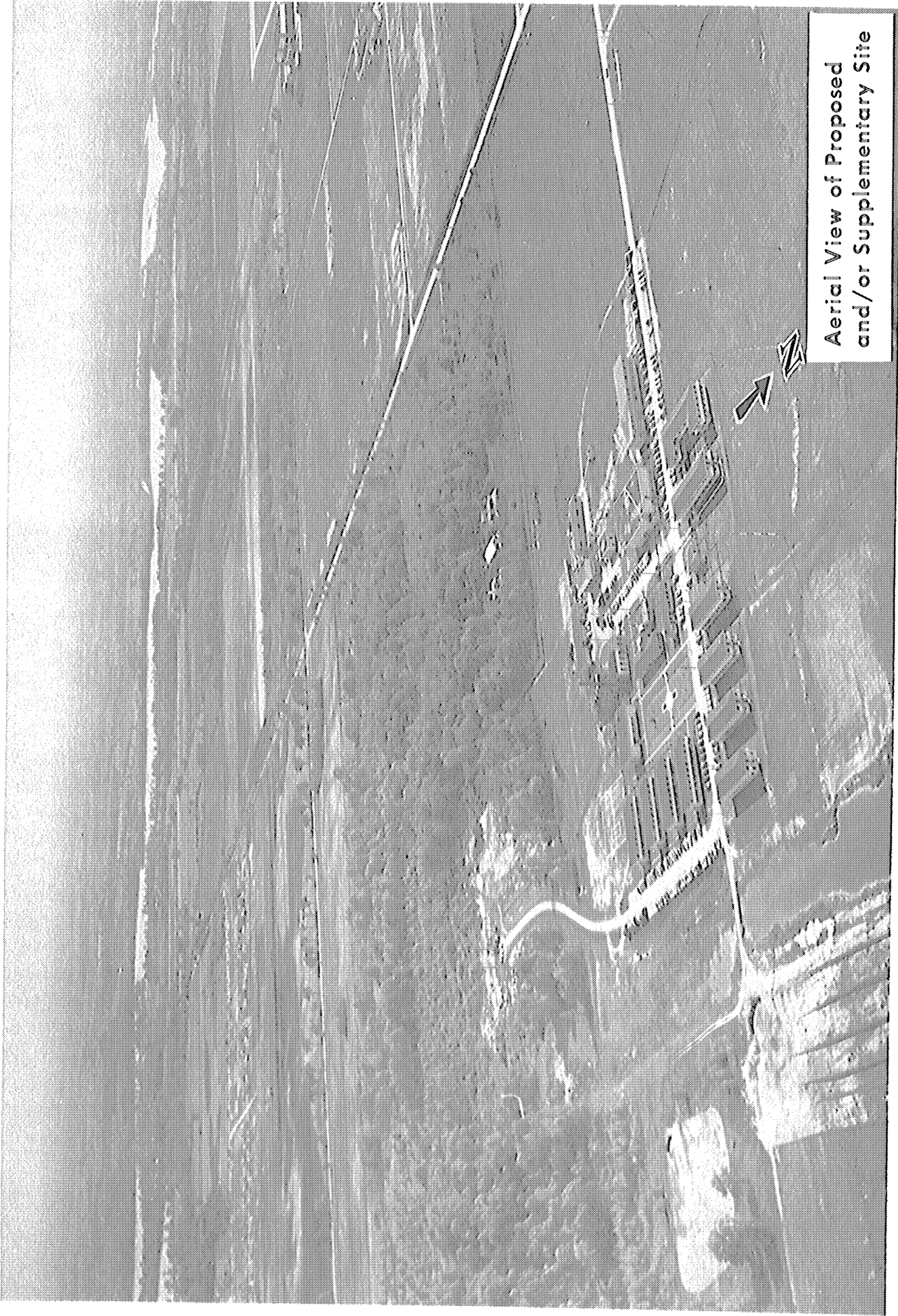
SCALE: 1" = 1000'  
0 1000 2000 3000  
F E E T











Aerial View of Proposed  
and/or Supplementary Site





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3 9015 03525 0615