UNITED STATES

DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

INTERAGENCY REPORT USGS-226

REMOTE SENSING PROJECT: TR-8

FINAL REPORT

by

Harry J. Mallon
and
Joan Y. Howard

February 1972

Work performed by the Metropolitan Washington Council of Governments for the USGS Geographic Applications Program under USGS Contract No. 14-08-0001-12708, and for the National Aeronautics and Space Administration (NASA) under NASA Contract No. W-13318, Task No. 160-75-71-03.

ABSTRACT

TITLE:	Final Report of the Metropolitan Washington Council of Governments' Remote Sensing Project
AUTHORS:	Harry J. Mallon and Joan Y. Howard, Department of Health and Environmental Protection, Metropolitan Washington Council of Governments
SUBJECT:	Summary Report of Remote Sensing Project: Period 13 February 1971 to 11 February 1972
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NUMBER OF PAGES:	27
ABSTRACT:	The report summarizes the accomplishments and publications developed by the Project during the Contract period which have illustrated a series of practical applications of remote sensing data to the urban-regional planning processes in the Washington metropolitan area.

FINAL REPORT OF THE METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS' REMOTE SENSING PROJECT

CONTENTS

1. INTRODUCTION

The purpose of this Project has been to conduct research on remote sensor applications useful to the planning programs of the Metropolitan Washington Council of Governments (MWCOG).

Planning for this project and the preliminary discussions between representatives of the Metropolitan Washington Council of Governments and the U.S. Geological Survey began early in 1969. The proposal soliciting the Project and identifying specific areas of work was developed and formally submitted to the U.S. Geological Survey for review and approval on July 2, 1970.

The proposal was approved and the contract signed on January 13, 1971 by the Council of Governments and on 20 January 1971 by the U.S.G.S. The language of the contract stipulated that the period of performance would commence within fifteen (15) days after approval of the Project Director, and run for a work period of nine (9) months. Work commenced on the 17th of February 1971 when the Project secured the services of Mr. Harry J. Mallon, as Project Director.

The goal of the project has been to investigate how remote sensing can be used to improve COG's data collection programs, to improve the usefulness of the information base, to support analytical techniques, and to assess whether its use can reduce the costs of data collection.

The program of research was commenced without delay, with the language and spirit of the Contract and proposal providing the basic guidance for planning and organizing the work on the specific areas of assigned research to be undertaken. The nine-month period of contract performance permitted little leisure.

Personnel procurement actions were initiated to obtain the services of a Research Assistant and Secretary. On the 29th of March 1971, Mrs. Joan Y. Howard, with excellent credentials, was hired and reported for work. Because of frequent turn-over, no one individual secretary was continously assigned on the Project, but secretarial support was provided by a series of several. However, during the closing period of the contract, the very able services of Mrs. Beverly P. Hall were secured.

An initial period of indoctrination was initiated which included visits and consultations with principals in the Geographic Applications Program (GAP), U.S. Geological Survey and in those within the various departments of the Council of Governments responsible for program planning, monitorship, and related areas of research and analysis. These COG departments included Regional Planning, Transportation Planning, Community Resources, Data Systems, and Health and Environmental Protection. It was necessary rapidly to establish close internal working relationships in order better to be able to understand COG's program data needs, priorities, data sources — their strengths and weaknesses, analytical methods, review and coordination procedures, and so forth.

It became evident very early during the discussions that there were certain priority areas of information need and planning concern to the Council of Governments. Principal among these included: Land use, urban change, housing, transportation, environmental impact, and generally the need to understand remote sensing data availability and its utilization in these and other applications. Within the constraints of its resources and of time, the efforts of the Project have attempted to be so guided and responsive.

The results of these efforts will be discussed in the ensuing sections of this report.

By September 1971, it was apparent that, even with the developed work momentum, team-work, and rigid deadline procedures, the assigned work would not be completed by mid-November — the end of the contract period. Accordingly, action was taken to request an extention of three (3) month's time at no additional cost to the Government. This was possible because projections indicated that funding not expended at the end of the contract period would support the required additional time. A formal request for extention was forwarded by the Executive Director, Mr. Walter A. Scheiber, to the U.S.G.S. on October 19, 1971. Approval was granted by the U.S.G.S. on the 22nd of October. This additional time, while still requiring adherence to strict deadline procedures, made the completion of work possible.

As the work progressed, interest in the success and status of the project grew - even from an initially high level. Interest in the progress and results of the work, as a pioneer effort, has been expressed by other planning organizations and by counterpart Councils of Governments in other parts of the country. (Copies of several letters of these types are included in the Appendices). Favorable public notice has also been accorded in the local press and TV media.

While there have been few opportunities afforded during this work period for the preparation or delivery of papers to external professional journals or groups on the results of this work program,

it is believed that there is now a substantial amount of material of interest available from this work to provide the substance for such publications in the near future.

This final report will attempt briefly in summary form to identify the accomplishments of the Project. The authors believe that they were significant. Details concerning the work in the several areas of research will be found in the technical reports themselves. Summary items in the following sections will describe the extents of that work.

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RESEARCH PROGRAM

The Project's research program, as has been stated earlier, was built around the Work Statement of the Contract. Seven areas of research were therein identified. The work was undertaken more or less in series, though not necessarily in the order as given. It was necessary initially to program the research in conjunction with related work being undertaken within GAP and for GAP by contract at the University of Iowa. Later the work was done on a sequential and progressive basis building upon studies undertaken previously. This was found to be a very solid approach and reflected generally the basic areas of priorities and remote sensing applications interest. The seven areas of research to be undertaken are listed below:

1. Identify specific problems of regional planning significance to which remote sensed information may be beneficially applied.
2. Determine remote sensing system requirements and cost effectiveness in relation to alternative data acquisition techniques.
3. Develop experimental programs to determine the most effective effective environmental impacts, and to demonstrate the utility of pertinent remotely sensed data from high altitude aircraft and ERTS-type satellites, to the urban planning process.
4. Provide at least one photo-interpreter to work with the GAP staff in the analysis and plotting of land use data from Government source photography on a data base map of the Washington Metropolitan area.

5. Evaluate, from the sensor viewpoint, applications of remote sensing techniques and data to urban change detection, land use analysis down to the census tract or other level, housing and neighborhood location and condition, and sediment control.

6. Verify interpretations of low resolution, high altitude photography of the Washington metropolitan area by the University of Iowa and U.S.G.S. Geographic Applications teams.

7. Compile a comprehensive inventory of existing photography of the Washington metropolitan area, consisting of the District of Columbia, Arlington, Fairfax, Loudoun, Montgomery, Prince George's and Prince William Counties; and the cities of Alexandria, Bowie, College Park, Fairfax, Falls Church, Greenbelt, Rockville, and Takoma Park.

During this research work, the Project team, working in a "user" planning organization environment with a high potential for remote sensing data utilization, focused its attention on feasible and practical applications wherever possible. Also, on those ocassions during the contract period, when "ad hoc" or short-fused questions arose from the COG departments, the team responded as it was able to provide timely, imagery-based information support.

Implicit in this research effort has been the ever-present consideration of the eventual use of ERTS satellite-derived data. The expected and impelling advantages of its large area and repettetive coverage — so suitable for regional study purposes - are anticipated with considerable interest by this as well as other planning organizations. Of course, the full impact of that program will not be measureable nor will all the areas of data useability be

until the data arrives, is processed, and analyzed. Nevertheless, as the basic information need to this organization has been a principal determinant during this research phase, and as satellite and aircraft-derived imagery will be utilized to the extent that both are able to provide the necessary inputs to the waiting information problem areas, examination has been made of imagery from examples of small and large scales and varying resolutions as it was applicable to the specifics of the data problem.

It is believed that the technical reports produced reflect this approach.

3. PUBLICATIONS

In direct response to the research task requirements described in the foregoing section, the following studies were undertaken. Titles and abstracts of their contents are listed below.

a. Technical Report No. 1, Inventory of Existing Aerial Photography of the Metropolitan Washington Area, August 1971, by Harry J. Mallon and Joan Y. Howard.

A comprehensive inventory of available photographic coverage, assembled to support the increased interest and utilization of aerial photography by planners in the Washington Metropolitan Area, is presented in this document. An index of existing photography covering areas and locations within the Area is submitted in textual and graphic formats. Specifications and information are provided for the researcher and others interested in the procurement of photographs from proprietary agencies, both governmental and private.

Status: Being utilized for internal research and library use by Geographic Applications Program (GAP), U.S.G.S., and the Council of Governments. Not released for publication at present.

b. Technical Report No. 2, Land Use Determination by Remote Sensor Analysis, September 1971, by Harry J. Mallon and Joan Y. Howard.

A land use analysis of 18 selected census tracts in the Metropolitan Washington area using aerial photography was undertaken in this study. A comparison of the results was made with comparable land use data from the Metropolitan Washington Council of Governments' Parcel File, and the results reported. Summary conclusions of photo-derived data in land use studies

by COG are made in this document.

Status: Released for publication by U.S.G.S. Available as Report No. PB-204246 from the National Technical Information Service, Springfield, Virginia 22151.

c. Technical Report No. 3, Determination of Land Use Change with the use of Aerial Photography, October 1971, by Harry J. Mallon and Joan Y. Howard.

The use of aerial phtography for monitoring land use change and for providing data to predict land use changes is examined in this study. Land use in seven census tracts in Fairfax County and the City of Alexandria, Virginia was examined on 1969 and 1971 photography and the changes recorded and analyzed. The study found that aerial photography provides a simple and rapid method of keeping land use data current and also provides a tool for predicting changes in land use.

Status: In the process of review by GAP, U.S.G.S.

d. Technical Report No. 4, An Assessment of Remote Sensor Imagery in the Determination of Housing Quality Data, November 1971, by Harry J. Mallon and Joan Y. Howard.

Selected census tracts in the metropolitan Washington area were examined using varying scales of aerial phtography. Observable characteristics of housing and neighborhoods were assessed to determine feasibility of providing data on housing stock and quality neighborhood condition from the imagery. Small scale imagery is shown to be of relatively marginal value in providing much of the data in the detail required, but can be useful for general survey purposes.

Status: In process of review by GAP, U.S.G.S.

e. Technical Report No. 5, An Evaluation of Applications of Remote Sensing Data to Metropolitan Washington Council of Governments' Planning Requirements, December 1971, by Harry J. Mallon, Joan Y. Howard, and Kenneth M. Karch.

A comprehensive inventory of a series of applications to which remote sensing data may be beneficially applied for use in a variety of regional planning programs of concern to the Metropolitan Washington Council of Governments has been undertaken in this study. Examples of application, method for data utilization and corresponding photographic illustrations are provided.

Status: Reviewed and released for publication by GAP, U.S.G.S.

f. Technical Report No. 6, Benefits from Remote Sensing Data Utilization in Urban Planning Processes and System Recommendations in the Washington Metropolitan Area, January 1972, by Harry J. Mallon and Joan Y. Howard.

The benefits of utilizing remote sensor data in the urban planning process of the Metropolitan Washington Council of Governments are investigated, including an evaluation of sensor requirements, a description/comparison of costs, benefits, levels of accuracy, ease of attainment and frequency of up date possible using remote sensor versus traditional data acquisition techniques.

Status: In the process of review by GAP, U.S.G.S.

g. Technical Report No. 7, Proposed Experimental Programs for Testing Remote Sensor Applications in the Metropolitan Washington, D.C. Area, January 1972, by Harry J. Mallon and Joan Y. Howard.

This report discusses a series of proposed experiments for testing remote sensing information applications in the metropolitan Washington, D.C. area. Specific sensor activity areas, wavelengths, and related ground truth relating to suggested investigations are discussed.

Status: In process of review by GAP, U.S.G.S.

4. SIGNIFICANT CONTRIBUTIONS

The research efforts described in detail within the technical studies have, in the opinion of the authors, presented a series of opportunities for an almost immediate initiation within the Council of Governments of an operational phase of remote sensor applications.

The remote sensing project team, during the past twelve months through its frequent exposure to the several COG departments, has developed a basis of understanding of their principal planning data needs and related priorities. Likewise, it is believed that this exposure has encouraged the development within those departments of a larger awareness of the value, (as well as the limitations) of remote sensing data usability.

Principal contributions of the Project might be identified as follows:

a. Prepared for the first time for use by local researchers and planning organizations, a comprehensive 20-year index of existing aerial photography covering the metropolitan Washington region.

b. Demonstrated a methodology by which the Council of Governments' computerized land use data base may be updated and improved by remote sensing inputs and how readily land use change may be detected and progress noted.

c. Examined and evaluated the visible parameters of housing and neighborhood condition in large and in terms of small scale imagery utilization.

d. Identified specific remote sensing applications in support of

regional transportation and water resources studies; solid waste site examination; pollution detection and monitorship; mapping and others.

e. During the course of the Project's program assisted in the development of techniques within COG's regional water resources research project, for using remote sensor imagery and automatic digital scanning devices for extraction of data not otherwise available.

f. Developed cost-comparison planning information of methods of remote sensing data acquisition and analysis on a broad range of applications.

Finally, it is significant to note that as a result of the project's initial work program, the local governments in their assessment of remote sensing data potential, have authorized the Metropolitan Washington Council of Governments, through its Board of Directors, to budget a token sum to support follow-on work during fiscal year 1973.

5. CONCLUSIONS AND RECOMMENDATIONS

Based upon the findings discussed in the several studies developed during this research period, there is little doubt that there are many aspects of the Metropolitan Washington Council of Governments' planning and information programs, which may be beneficially supported by the utilization of remote sensor-derived data.

The relative importance to COG of these various applications in terms of current and longer range information needs vary, of course. Several of these applications would appear to have an almost immediate application potential; others could be initiated at a later date; and still, others on a contingency basis in the event of special need.

Included in the first group, for example, would certainly be a program of land use analysis and update based upon regional change; another one, data acquisition and analysis in support of a variety of transportation study needs. Within the second group would be a series of studies including surveys of open spaces; monitorship, for sediment control purposes, of exposed soils and cut-off areas; inventorying of possible water catchment and retention areas within the region; study of encroachment by urban growth on natural resource extraction activities such as sand and gravel operations; measurement of floor space and building density factors for development of employment data within areas of the region; and location and count of new dwelling units. In the third group would be applications which are either of a "one time" nature where imagery would be required to survey a

major event in the region such as a large oil spill or other pollutant release or an unusually large water run-off following prolonged rain fall or Spring snow melt; or else to conduct a one-time survey of, say, types of neighborhoods within the area.

For some of the above instances, by themselves, acquisition and analysis of remote sensing data might not prove cost-effective. However, under certain circumstances it would be possible to combine data needs for collection by a single photographic mission, thus improving the cost-relationship factors. In other cases, data acquisition of remote sensor imagery covering portions of the region or a single event occuring within it might suddenly become feasible because of the importance of the event or the pressing need for the coverage.

Accordingly, as a consequence of the results of the investigations conducted during this project, it is recommended that there be an early implementation of a small operational remote sensing unit with the MWCOG. This unit should be programmed to function as to carry out the applications which the findings of this Project have proposed, and to be responsive to provide staff data support where possible in the utilization of aircraft and impending Earth Resources Technological Satellite (ERTS-A) derived data.

6. ACKNOWLEDGEMENTS

Grateful acknowledgement must be given to all the members of the Council of Governments' Administrative and Departmental Staffs for the help, guidance and enthusiastic support given the Remote Sensing Project Team during the course of this research program.

Many thanks are also due to the members of the staffs of the U.S. Geological Survey in the Geographic Applications Program and EROS offices for their continuous guidance, advice, and understanding support rendered this new project at the Metropolitan Washington Council of Governments.

Finally, sufficient appreciation cannot be expressed to those many individuals who have provided secretarial, graphics, and other necessary support for the almost continuous deadline sequences during the course of this project and without whose assistance the completion of this work would not have been possible.

7. APPENDICES

APPENDIX A

Letter from the Maryland Department of

State Planning

August 30, 1971

To: Mr. Francis B. Francois, President, Metropolitan

Washington Council of Governments

MARYLAND
DEPARTMENT OF STATE PLANNING
301 WEST PRESTON STREET
BALTIMORE, MARYLAND 21201
TELEPHONE: 301-383-2451

MARVIN MANDEL
GOVERNOR

VLADIMIR A. WAHBE
SECRETARY OF STATE PLANNING
NORMAN HEBDEN
DEPUTY SECRETARY

August 30, 1971

Mr. Francis B. Francois, President
Metropolitan Washington Council of Governments
1225 Connecticut Avenue, N. W.
Suite 201
Washington, D. C. 20036

Dear Mr. Francois:

The Department of State Planning is currently compiling a catalogue of available aerial photography of the State of Maryland. When completed, the catalogue will be made available to all State agencies and regional and local jurisdictions for use in planning and engineering activities. We anticipate that the existence of such a document will minimize duplicative acquisition of aerial photography and promote sharing of existing imagery.

So that the aerial imagery resources of your organization can be included in the catalogue, I would appreciate a listing (if available) of the photography available through your organization, the types of imagery available (i.e., black and white, infra-red, scale, etc.), the procedure for obtaining copies of the imagery and the name, address, and telephone number of a person to contact for additional information (to be included in the document). If you require further information from the Department of State Planning, please contact John C. Antenucci at 383-2477.

Sincerely,

Vladimir Wahbe

Vladimir Wahbe

APPENDIX B

Letter from the Indian Nations Council of Governments

Tulsa, Oklahoma, December 20, 1971

To: Mr. Walter A. Scheiber, Executive Director,

To: Metropolitan Washington Council of Governments

Indian Nations Council Of Governments

0 West Seventh Street - Tulsa,Oklahoma 74127 - Area Code 918 587-3178

December 20, 1971

Mr. Walter Scheiber, Executive Director
Metropolitan Washington Council of Governments
1225 Connecticut Avenue, N. W.
Washington, D. C. 20036

Dear Walt:

Recently I attended a session hosted by the Ozarks Regional Commission relative to the Earth Resources Observation Systems (EROS) project. During the presentation by Mr. George L. Loelkes it was mentioned that Washington COG was using high altitude photographs in your land use and housing activities.

Due to the fact that our organization has been asked by the State to participate in developing a proposal to make Oklahoma an EROS test area, I am most interested in any information concerning the benefits or limitations your organization has found in participating in this technique.

Sincerely,

Denton U. Kent
Executive Director

DUK:kc

P.S. Looking forward to seeing you in Portland.

APPENDIX C

Letter from the Economic Development Council of Northeastern Pennsylvania, Avoca, Pa.

September 7, 1971

To: Remote Sensing Project Director, Metropolitan Washington Council of Governments

ECONOMIC DEVELOPMENT COUNCIL
OF NORTHEASTERN PENNSYLVANIA

P.O. BOX 777 • AVOCA, PA. 18641 • TEL. 717/457-7456

September 7, 1971

Mr. Henry J. Mallon, Director
Remote Sensor Program
Metropolitan Washington Council of Governments
1225 Connecticut Avenue, N.W.
Washington, D.C. 20036

Dear Mr. Mallon:

I read in the August 1971 issue of the newsletter of the American Society of Planning Officials of your Remote Sensor Project to monitor land use and environmental changes in the Washington area. Apparently you have a nine-month contract with the U.S. Geological Survey to determine how special techniques can be used as a planning tool.

I would appreciate receiving information concerning this program and, if possible, its applications in other regions of the country.

Thank you very much.

Yours truly,

Howard J. Grossman

Howard J. Grossman
Executive Director

HJG:alp

APPENDIX D

Letter from the CONSAD Research Corporation

Pittsburg, Pa., July 12, 1971

To: Remote Sensing Project Director, Metropolitan Washington Council of Governments

CONSAD

CONSAD RESEARCH CORPORATION
121 North Highland Avenue
Pittsburgh, Pennsylvania 15206
Telephone (412) 363-5500
Cable Address—CONSAD

July 12, 1971

Mr. Harry Mallon
Metropolitan Washington Council
of Governments
1225 Connecticut Avenue, N.W.
Washington, D. C. 20036

Dear Mr. Mallon:

I am writing to you at the suggestion of your Mr. Kenneth M. Karch, regarding the availability of aerial photographs of the area within a five-mile radius of Dulles International Airport. As Mr. Karch may have mentioned to you, we have been contracted by FAA to do a Community/Airport Economic Development Model for which Dulles is to be the test area. Since the purpose of this model is to analyze the compatibility of the various proximate activities with aircraft noise, such aerial photographs, if available, would provide us with much information. We would greatly appreciate anything in this area that you could send us.

Thank you for your trouble.

Sincerely,

Robert A. Berman

RAB:amm

APPENDIX E

Letter from WETA Television/Radio Station

December 30, 1971

To: Remote Sensing Project Director, Metropolitan Washington Council of Governments

December 30, 1971

Mr. Harry J. Mallon
Director, Remote Sensing Project
Metropolitan Washington Council
of Governments
1225 Connecticut Avenue, N. W.
Washington, D. C. 20036

Dear Mr. Mallon:

I want to thank you for your kindness in loaning us copies of aerial photographs for our use in a program in our new series, IS IT YOURS? I am grateful to you, also, for directing me to Mr. Wray and the Census Cities Program and I shall plan to meet with him soon.

I enjoyed meeting you and talking with you. Many people at COG have been helpful to me in the production of IS IT YOURS? I hope I will have another opportunity to meet with you.

Sincerely yours,

Harriet B Baldwin

Mrs. George B. Baldwin

HB/ks