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REMOTE SENSING AND TECHNOLOGY TRANSFER PROJECT

7.8 - 10-14  
CR-157176

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Director

American Indian Communities  
TV Project

American Indian  
Languages and Literature  
Program

Community Education  
Project

Humboldt Co.  
Recreation Project

Indian Mainstream  
Industries Project

Kotim Een Karuk  
Ceremonial Society

Multi-Cultural Education  
Project  
N.A.S.A. Remote Sensing  
Technology Transfer  
Project

National American Indian  
Repertory Theatre Project

Northern California Health  
Systems Agency Support  
Project

Redwoods Community  
Development Council  
Project

Wood for Seniors  
Project

DEVELOPING AND DEMONSTRATING  
AN INSTITUTIONAL MECHANISM FOR TRANSFERRING REMOTE SENSING  
TECHNOLOGY TO 14 WESTERN STATES USING NORTHERN CALIFORNIA  
AS THE TEST SITE

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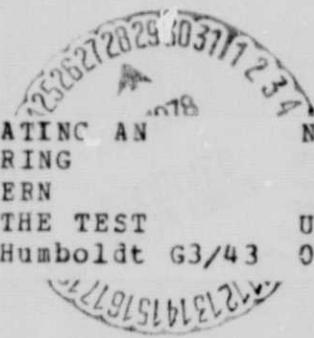
PROGRESS REPORT  
COVERING PERIOD  
JUNE 1, 1978 THRU MAY 31, 1978

DOMNA HANKINS  
PRINCIPAL INVESTIGATOR  
NASA GRANT 2244

(E78-10142) DEVELOPING AND DEMONSTRATING AN  
INSTITUTIONAL MECHANISM FOR TRANSFERRING  
REMOTE SENSING TECHNOLOGY TO 14 WESTERN  
STATES USING NORTHERN CALIFORNIA AS THE TEST  
SITE Progress Report, 1 Jun. - 31 (Humboldt G3/43

N78-26512

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Report No. 2

## INTRODUCTION

To best document the activities of the first year, I will restate the title and eight basic goals of the original proposal.

### DEVELOPING AND DEMONSTRATING AN INSTITUTIONAL MECHANISM FOR TRANSFERRING REMOTE SENSING TECHNOLOGY TO 14 WESTERN STATES USING NORTHERN CALIFORNIA AS THE TEST SITE

There is a strongly demonstrated and thoroughly documented need for an ideal institutional mechanism to bring about the successful and meaningful transfer of technology in the world today. It is an acknowledged fact by many experts dealing in the various aspects of this problem that no such mechanism exists. It is further acknowledged, and documented, that the technology of remote sensing is, and can be, a fitting, timely, cost-effective tool for inventory, assessment and monitoring of the natural resource base of the nation.

A powerful example exists in the findings of the Pacific Northwest Regional Commission's, Land Resources Inventory Demonstration Project of the states of Idaho, Oregon, and Washington. Through this, and other projects using remote sensing as an information gathering and analytical tool, it has been shown that this technology, when used in resource management and planning, can add significantly to the planning and decision-making process at Federal, state, and local levels.

This proposal, and its related activities, will provide, on a demonstration basis, a model for transfer of remote sensing technology and the model institutional mechanism for transfer in 14 western states of the United States.

The eight basic goals of the proposal are:

1. To interact with the Pacific Northwest Regional Commission's Land Resources Inventory Project, to make direct use of their expertise and findings.
2. To create, design, and implement a model for remote sensing technology transfer using a small test site in northern California for maximum efficiency, interaction between participants, and economy in both human energy and dollar costs.
3. To transfer and disseminate knowledge of the techniques and applications of remote sensing, as used in the test site, to 14 western states in the western region.

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4. To transfer and disseminate information and findings regarding the transfer Model and its institutional mechanism to the 14 western states region, and nationally.
5. To establish and test a working communications model (between project participants, and between the project and the public at-large) within the 14 western states region, and nationally.
6. To establish an innovative and effective documentation system, and to test that system as used in the demonstration project, and in the 14 western states region.
7. To establish and document communication links from the project to decision makers, individually, to decision making bodies and processes at Federal, state, and local levels within the 14 western state region, and on a national basis, where appropriate, as to viability of use of remote sensing in the decision-making process regarding the natural resources.
8. To formulate a series of recommendations and guidelines with input from all participants in the demonstration project and that will incorporate all of the above items, and will also include such key elements as analyzing social implications and cost-effectiveness of the use of remote sensing as an information gathering and analytical tool in resource based problems of northern California.

The proposal, and its related activities, will practically address some specific resource based problems in the disciplines of Forestry, Ocean and Coastal lands, River basins, and selected land use. In the Inter-cooperative project, National Aeronautics and Space Administration (NASA) personnel will participate with selected Federal, state, and local agency personnel; Humboldt State University professors, schools, and departments; The Center for Community Development; and, a Citizens Task Force and study group. The testing site will be physically located in northern California in a demonstration area that has several overlapping problems and projects already in existence, and will provide the ideal testing situation to achieve the goals of the proposal.

Coordination, documentation, dissemination, and communications regarding this test and demonstration site will be provided at the Center for Community Development, Humboldt State University, under the direction of the principal investigator, Donna B. Hankins, assisted by support staff and Dr. Lawrence Fox, Humboldt State University Forestry and remote sensing instructor. NASA will provide basic technical support (e.g., data needed by project participants, imagery, image processing, orientation programs,

and so on) and training of project participants in the basics of remote sensing and techniques of application of the technology to the problems at hand. NASA will also provide valuable assistance and cooperation in the form of coordination, documentation, dissemination and communications from the local test site, to the western 14 state region.

These latter activities will take place at a facility near Ames Research Center, Moffett Field, California, which will provide for the training and coordination activities by use of a team of individuals selected especially for their demonstrated capabilities in the fields of remote sensing technology, communications, education, administration, and research. The entire multi-disciplinary team will interact either at Humboldt State University or at NASA Ames Research Center, or in the 14 western states region, as necessary.

The length of the demonstration project is expected to be approximately 3 years, with a start date of June 1, 1977, and an ending date of May 31, 1980.

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Second, from the "Introduction" section of the original grant proposal, I will restate the portions which:

- Outline the need for developing an institutional mechanism for transfer of aerospace technology, and
- State the major barriers to developing and implementing such an institutional mechanism.

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There exists at present no institutional mechanism that permits the large body of potential users--existing in federal agencies and in state and local governments, in industry and the business community, and in educational institutions--to express their needs and to have a voice in matters leading to the definition of new systems. To date, it is the providers of space systems and information who devise what they believe are useful requirements and proceed to build experimental systems. They then find themselves in the position of trying to "sell" this technology to prospective users. While this process works well (and needs to be continued) for stimulating technology, it needs to be reversed with regard to involvement of the users. There is then a perceived need for some institutional mechanism designed to assure participation in defining new applications.

The institutional problems are ones of organization, communication and leadership--problems which can only be ameliorated by establishing some means in addition to those which the Nation has developed to date for dealing with space technology. Such a mechanism (or mechanisms) is

required to serve the following functions:

- A. Provide general policy direction
- B. Set priorities
- C. Provide for communication between users and providers
- D. Encourage non-federal involvement and investment

To facilitate these functions, the utilization, with their fullest consent possible, of the services, personnel, equipment, facilities, and information (including statistical information) of public and private agencies and organizations, and individuals, in order to avoid duplication of effort and expense, will be a necessary component. This utilization will also provide the necessary building blocks to identify and define the civilian problems at state, regional, and local levels which science, engineering, and technology may assist in resolving and/or ameliorating. As a necessary component, these "building blocks" will identify and foster ways to facilitate the transfer and utilization of research and development results to maximize their application to civilian-user needs. Concomitantly, it will result in improved methods for effecting transfer, innovation, and use of technology by users, and, by stimulating an effective liason between Federal, state, and local agencies, and industry and private user groups.

However, to achieve all of the fundamental and necessary components mentioned above, it is well to recognize the barriers to the development of an institutional mechanism. If these barriers are recognized and dealt with in a positive manner, their potential for causing the failure of an institutional mechanism will be eliminated.

The major barriers are:

1. Lack of awareness on the part of the public at-large, the business community, state and local agencies to utilization of NASA and space technology--inertia barrier.
2. Too many federal agencies trying to transfer technology to the private sector with no formal policies.
3. Federal agencies not equipped to directly transfer technology--non-existent transfer mechanism.
4. No organized effort on the part of agencies who develop the technology to market or transfer it to others--non-existent transfer management and organizational structure.
5. Communication barrier.

6. Limiting budgetary constraints on NASA's transfer program as well as other agencies--cost barrier.
7. Time and geographic distance barrier.
8. Reluctance on the part of industry to take the risks involved with developing the necessary products to disseminate the technology.

All of the above barriers should be addressed initially in any program designed to transfer technology. Dr. Hans Mark, past Director of NASA Ames Research Center, has stated the following:

The least successful way of "transferring technology from one purpose to another is to have the federal government do it directly....This is principally a result of the people within the federal government not having the necessary skills to effect the transfer. Successful transfer requires that a market for the technological product be available, ...is adapted well enough to that market so that accurate cost projections can be made, that...risk capital be accumulated, and that the special organization be created to carry the new product successfully to the market-place."

As to the role of the federal government in facilitating this process:

"The process of technology transfer is an important one that must be nurtured and encouraged. It is strongly recommended that, in view of our experience in this field, proper incentives be provided for private industry and for individual technical people to encourage the transfer of appropriate technology to commercial markets as soon as feasible. In addition, it is important that the Federal Government, in undertaking a technology development program, understand thoroughly which part of the development is best done by private industry and which part is best accomplished under federal direction."

Mrs. Sally Bay, of the Task Force on Technology of the National Council of State Legislatures in its 1977 report to the Council, stated:

"...the task force strongly emphasizes that the satellite technology may not be transferred to the state and local governments--due to flaws in the transfer process, rather than in the technology itself."

Thus, the problems and barriers are present, but can be eliminated. This proposal will deal in a real way with the problems from the very beginning.

The "model" being proposed will gather together all the elements necessary to bring about complete coordination between those who do the technical application, and those who will disseminate and publicize the results. In this way, the institutional mechanism will not only be developed, but will be in operation from the start. It will coalesce into a standard operating mechanism that will, with changes relevant to each region, facilitate the transfer of the technology, and, insure that the model is applicable to other areas as well.

In designing a comprehensive technology transfer program for our model region, careful consideration was given to the major potential transferring elements of this program. In other words, what are the unique features of the region that will aid or facilitate transfer?

In Northern California (here described as Humboldt, Del Norte, Mendocino, Siskiyou, Shasta, Modoc and Lassen Counties), Humboldt State University and several community colleges were identified as prime factors for technology transfer. The two key places within the university and community colleges where technology transfer can be facilitated are:

STUDENT BODY - University training in remote sensing in a multi-disciplinary, well integrated program provides a core group of trained and knowledgeable people that will more readily utilize the technology as they go into their various discipline fields to work. At Humboldt State University, over 2,000 persons are enrolled as Natural Resource majors. By integrating remote sensing technology into a wide range of curriculum areas at Humboldt State, the technology users of the near future are created. Furthermore, this is an enhancement to the current offerings of the university, and should create new FTE dollars for the schools as more students become aware of the opportunity to add a valuable new skill to their regular discipline field.

ACADEMIC FACULTY/STAFF - By training of selected university professors in remote sensing technology, integration of the technology into various curriculum areas can more quickly and easily take place. Furthermore, this training helps create a core group of trained discipline scientists who can assist in teaching and training those community and agency personnel involved in projects using the technology. Finally, new research in various discipline areas will take place after such training, providing enrichment and personal development for academic persons.

The report which follows documents the work of 1977-78 within the university community.

I. HSU Student Involvement

A. Remote Sensing of the Environment. In conjunction with Continuing Education, the NASA grant, Schools of Forestry, Science, Natural Resources, Winter Quarter 1978, an introductory course on remote sensing was offered. The course, designed to provide an overview of the theory and applications of the technology, had a concurrent enrollment of 80 University students and 22 Continuing Education students. In an attempt to provide wide coverage of the applications of the technology, the grant provided the following speakers:

1. Nancy Grabinski-Young: Tacoma, Washington, Urban Project, Applications in Land Use and Urban Analysis.
2. James Jeske: NASA Computer Applications Specialist; Applications for Automated Image Interpretation.
3. Dr. Floyd Sabins: Research Scientist for Chevron Corporation; Applications in Geology, Soils, Mineral Resources.
4. Ernest Dagher: National Environmental Satellite Service; Applications in Climatology, Hydrology, Environmental Monitoring.
5. Dr. Robert Hodgson: Humboldt State University; Applications in Oceanography.
6. Alan Snell: COMARC, Inc.; Applications for Social Impact and Technology Assessment.

This course was repeated as a regular University offering during Spring Quarter 1978 at Humboldt State.

B. In an effort to provide students with information and resources on remote sensing, the Project office has compiled a listing of students wanting to become involved. This listing can be broken down as follows:

1. Volunteers: Those interested in offering free time and unpaid energy (15 students).
2. Class Units: Those interested in gaining units under 199 Study Series, Independent Research, Field Classes, etc. (23 students).
3. Part-Time/Full-Time Employment: (12 students).
4. Graduate Level Research: Interested in applications of remote sensing to graduate research (15 students).

Also, student requests for information that can be used for class presentations of remote sensing applications (38 students).

NOTE: Three students in particular have been using remote sensing materials to define class projects that will lead to graduate level study.

- C. During Spring Quarter, March 27 - June 10, 1978, a student intern worked directly with the Project office to survey existing legislation regarding remote sensing technology. It is hoped that a state-level intern program will be developed from this research.
- D. Career Development. The Project in conjunction with the Career Development Center at HSU, held a one-day workshop on "Careers in Remote Sensing." A brochure developed for the workshop has begun distribution throughout 14 western states to colleges and universities. It is hoped that other programs between Career Development and the Project will include conferences, workshops and seminars to provide students with new ideas for future employment.
- E. Throughout the past academic year, Donna Hankins, Joe Webster, Dr. Lawrence Fox, and Kamila Plesmid have made numerous presentations to classes and organizations on campus. This effort is viewed by the Project as a necessary responsibility to keep students and faculty fully informed and aware of remote sensing technology.
- F. At the present time, two Graduate students, one in Forestry and one in Natural Resources, are currently working with the grant on demonstration projects. Ken Mayer, graduate in Natural Resources, is working in cooperation with the Project and the U.S. Fish and Wildlife Service on an investigation of the Hoopa Square. Jeff Soto, graduate in Forestry, is doing thesis work related to an overall vegetation cover classification on the Hoopa Square. Other activities of these two students include: Mayer providing lab assistance to Dr. Fox in the remote sensing course, and Soto doing training in photo-interpretation and mapping with Indian groups on the Klamath River; both students are gaining valuable training in the use of computer processing of Landsat data on-site at HSU and at NASA Ames Research Center.

## II. HSU Faculty Involvement

- A. On December 3, 1977 and January 7, 1978, workshops were given to provide faculty and staff with information on remote sensing technology. Forty-eight members of the faculty attended these workshops and from them a series of action items were developed. From the action items, a steering group headed by Drs. Fox and Hodgson, have developed a proposal for summer training at NASA Ames Research Center. This advanced training is intended to

provide Humboldt State with a core group of professors well-versed in the technology and represent a multi-disciplinary group of concerned faculty members. It is hoped that through this training the integration of remote sensing programs into existing curriculum offerings can be accomplished.

- B. Through arrangements and contacts at NASA Ames Research Center (ARC) and in consultation with Dr. Joseph Leeper, a sabbatical for Dr. Leeper to be spent at Ames has been given full approval (from NASA Ames). We would hope that these types of arrangements, at various times, could be provided other professors in the future.
- C. Drs. Lawrence Fox (Forestry) and Robert Hodgson (Oceanography) during the past summer were able to get further training in the use of remote sensing and computer processing of the data. Through this training, it is felt that the University has been able to increase faculty awareness of the potentials of remote sensing technology. Also, Dr. Hodgson was able to gain valuable knowledge concerning the current "State of the Art" in remote sensing around the United States. His input and documentation has led to a broader outlook on the part of NASA Ames as to what changes are necessary vis-a-vis the dissemination of the technology.  
  
Dr. Fox has continued his association with the grant through a consultancy arrangement. His valuable input on technical matters has been instrumental in providing for coordination and development of the existing demonstration projects. This will benefit Humboldt State by having at least one professor who is cognizant of the full use and applicability of remote sensing technology. Dr. Fox will be employed by the Project throughout the upcoming summer to provide continuity to new projects and planning for the future. Also, he will be involved with insuring that the summer program for professors is carried out effectively.
- D. Various professors on campus have consulted with the Project on the possibility of gaining support for research proposals that may or may not be applicable to remote sensing. At present, these proposals are being reviewed by many individuals in the NASA system. We are hopeful that these proposals will be funded.
- E. After consultation with representatives of HSU's Computer Center, we feel positive about the integration of Landsat data processing into the current system. There are, however, some very real problems. Much of the existing equipment would need to be added to for full capability. Also, storage and retrieval capacity would need updating, as well as the possible increase in manpower to work with such a program.

One of the unique features of any region that will facilitate transfer of technology is the web of the "community." An informed and aware community can assist technology transfer by influencing decision makers and by passing needed legislation. We have defined this "community" to encompass the general, lay public, local and regional; agencies or potential/actual user groups, local and regional; major industries and decision and policy makers. Thus, our definition includes a "community" which reaches from right outside the window to Washington, D.C. In Northern California, this community is extremely diverse, if sparse. Here, the Natural Resource is the direct economic base. The general lay public is employed by or closely connected to the major industries which extract the Natural Resources. Furthermore, the agencies work with, monitor, control or assist extraction of the same resources and the regional decision and policy makers are usually keenly aware of the problems of the resources, their allocations, etc. Hence, any "tool" which even promises better and more cost-effective inventory, assessment and monitoring of the same resource base is guaranteed to at least receive modest attention.

So, the first stage of our approach in Northern California has been to essentially "scan" the local market and decide upon several communication modes best designed to inform about and increase awareness of the technology in the community as defined. Furthermore, assessment of all California was judged a necessary task, to, again, determine what the potential market might be for this technology in a state which has encountered numerous past problems in getting involved. (No assessment has yet been made of the projects and actual user groups of the WRAP area to determine the entire potential market for the technology in 14 western states.)

Communication models are being currently assessed, after one year of work, for identification of those elements which need further attention.

The following report details the major efforts made by the project in informing and involving the "community," as defined above.

- III. Community Involvement. As part of the overall tasks and responsibilities of the grant, extensive community awareness has begun. This community program has been viewed as an integral part of any technology transfer effort.
- A. Community presentations - Project staff have made over 50 presentations to business (e.g., Lions, Kiwanis, Rotary) and civic groups to stimulate awareness in the community. The response from these groups has been favorable and has led to many important viewpoints being given expression. These presentations are expected to continue.
1. Business and Industry: 286 people
  2. Decision-makers: 167 people
  3. General Educational: 634 people

- B. Signature - The project is currently publishing a newsletter which is being sent to most of the fifty states and a few foreign countries. The content of the newsletter provides a synopsis of activities in the Northern California area; information on legislative programs, conferences/workshops; and, images of key personnel involved in technology transfer. Under the editorship of Ms. Kamila Plesmid, this newsletter is now being expanded to cover the entire 14 western state WRAP (Western Regional Applications Program) service area.

- C. American Indian Tele-communications Satellite Demonstration Project - Throughout the United States, a large percentage of landholdings are held by various Indian Tribal groups. As they have recently been given the right to develop their own lands, information and training as to the best possible ways to achieve this task has become important. The "tele-communications project" is a demonstration in attempting a new method of education and information dissemination.

The grant, in cooperation with Mr. Jerry Elliot of Johnson Space Center, Houston, has been given two major tasks for this project. First, to develop a video-tape that will show the technology transfer/education program currently in operation in Northern California. Second, to provide expertise in evaluation of the effects of this overall program in its first attempt.

The video-tape program (20 minutes) will provide background to the grant, its activities concerning technology transfer, and its efforts on behalf of the Indian community on the Hoopa Reservation and extension. The evaluation scheme is to provide for input into the effectiveness of this type of program development throughout the United States. This program was initiated in early April, 1978.

- D. Documentary Film - The grant has been involved with a documentary program that is intended to provide visual documentation of its activities. This film, in progress at this time, will cover the interactions of the grant personnel in dealing with day-to-day problems, and development of the technology transfer mechanism. This film will also be used to explain how technology transfer can work, who were the participants/actors in the process, and how others can become involved.
- E. Simulation Activity - In reacting with members of the community-at-large, grant personnel have been developing a "simulation activity." This simulation is intended to 1) establish a level of awareness for the technology, 2) show how the information is needed, and 3) improve the awareness of how the technology can be integrated into traditional information gathering needs. Ms. Marion Dresner,

graduate student in Natural Resources, HSU, has been instrumental in providing the framework within which the activity is to take place. The simulation has been used in a trial session with a group from the community. From that session, we will refine the activity into a format that can be applied in other areas and with other groups.

SUMMARY -- The community awareness program of the grant is quite extensive. It involves not only Northern California, but the full 14 western state region. The grant personnel believe that this program will be an ever expanding process and are taking the necessary steps to insure its completion.

IV. Training activities. A major component of grant activities has been to develop "training" programs that assist the transfer of technology to users. Each of the following training sessions followed a basic format of instruction:

1. Introduction to the technology - remote sensing theory.
2. Applications of the technology - applied remote sensing.
3. Exercises designed to provide use of remote sensing data.
4. Follow-up activities to provide better techniques for training programs.

As more potential users become familiar with the technology, these training programs will increase. Following is a list of training programs completed as of May 31, 1978.

Each program was designed to give each participant knowledge of the technology as it related to the specific agency.

- A. State Agencies: 135 people
- B. Federal Agencies: 126 people
- C. Local Agencies: 179 people
- D. University/Faculty: 173 people

V. California Activities. As the grant is intended to pursue its goals as a model to be applied throughout 14 western states, it is necessary to develop the model in that context. To do so implies gaining information concerning those areas. The following is a summary of the activities regarding the State of California.

- A. Demonstration Projects - The technical demonstrations of the use of the technology have been the hardest program areas to be initiated. Part of the problem has been the lack of trained personnel to take part in this activity. However, if the program here at HSU is to be effective, this element must be increased. Working with the technologists at NASA Ames, the project personnel are now in a position to finalize and place more emphasis on this segment of the program. The technical know-how and coordination will be tightened and "brought-up-to-speed" to insure adequate technical development and use.

At present, there are three demonstration projects in progress: 1) U.S. Fish and Wildlife Service study of the Trinity River watershed on the Hoopa Square; 2) Hoopa Square overall vegetation cover classification graduate research project, HSU; 3) Klamath River, basic photo-interpretation/mapping program for U.S. Census Bureau and Indians on the Klamath River. These three programs are underway and the participants (Ken Mayer and Jeff Soto) are working in conjunction with the agencies and individual groups concerned. (See attached Project Statements.)

Along with the three projects mentioned above, the following is a list of proposed projects that are currently under negotiation.

1. Trinity River Task Force: Trinity River Basin in Northern California; 11 agencies (federal, state, local) involved.
  2. Six County Regional Proposal: six counties in Northern California possible joint powers proposal.
  3. California Parks and Recreation: Redding, California region.
  4. Archaeological/cultural Resource Consortium: Northwest California, proposal to utilize remote sensing techniques investigating cultural and archaeological sites.
- B. California State Survey of Remote Sensing Activities - In many ways the project has found that very little information has been shared concerning the use of remote sensing technology. A survey has begun on developing a compendium on these activities. Its goal is to provide anyone interested with a list of projects going on in universities, state colleges, federal and state agencies, county departments and industry. This survey will be forwarded to NASA Ames and the Governor's office as soon as complete (expected completion -- end of June, 1978). This will be the first time that such information will be available and represents seven months of constant involvement and compilation.

- C. Proposed California Task Force - The Project has assisted in developing a proposal for a State of California remote sensing task force. The purpose of the group will be to coordinate all activities in the State of California using remote sensing technology. As a beginning step, assisted in charter meeting of the California Remote Sensing Advisory Council (CRSAC) representing agency persons utilizing or wishing to use remote sensing in their activities. The CRSAC is viewed as a foundation for coordination between state, university, and industrial groups wishing to form State Task Force.

SUMMARY -- The activities in California are intended as initial steps in providing for long-range planning for the use of remote sensing. The "Survey" and activities of the demonstration projects are viewed as focal points for future expanded use of the technology.

- VI. Western Regional Applications Program (WRAP). As part of the grant's goals and objectives, we are to provide a "test-site" for ideas and actions, and become a "model" for WRAP objectives in 14 western states. The project staff at Ames has been moving on all fronts in an attempt to generate interest and ideas/actions throughout this area. The following are highlights of that program:
- A. Centralizing State Interests - The team at NASA Ames has been in contact with individuals within each of the 14 western states. These groups represent legislators, top-level agency heads, universities and industrial concerns. Many of these groups have centralized their contact through one or more individuals who will act at focal points for communication and activities. Specifically, these focal point individuals and groups will provide coordination between their states activities and those of WRAP. Using the experiences gained through the Northern California test-site, each state will have a coordinated and inter-cooperative team to define project activities. A network for communication dissemination will then be firmly established throughout the region.
- B. University and College Survey - As the Humboldt State Project office is surveying remote sensing activities in California, the WRAP program is surveying universities and colleges throughout their service area. Specifically, each university and college will be quizzed on 1) their existing (or non-existing) programs in remote sensing, 2) their level of course work and/or knowledge of remote sensing, and 3) if they are going to become involved with, or expand the programs in, remote sensing.
- C. State Programs in WRAP
1. Arizona: Through ARIS (Arizona Resource Information System), a data base for the state, WRAP is helping to define a series of projects with the Jet Propulsion Laboratory, Pasadena. This support is now in its final state. One example of how this is working is the legislative proposal to move ARIS into the Arizona State Department of Lands. In doing so, increased data needs and services will help expand the program.

2. Colorado: The Colorado State Mapping Advisory Committee has been appointed as the focal point for remote sensing activities. Negotiations are now in progress to set-up a joint presentation between WRAP and State offices in the use and capabilities of remote sensing.
  3. Hawaii: In November, 1977, seven individuals representing various resource agencies attended a two-week training program. Sponsored by the grant, NASA Ames and in cooperation with U.C. Berkeley, the theory and application of remote sensing was explained and hands-on training provided. From that session, State agency heads have been designated as a Task Force to coordinate any remote sensing programs. This group, in cooperation with WRAP Program leaders, is now attempting to define a project proposal plan.
  4. Montana; A series of orientation and brief training sessions at NASA Ames and in Helena have been accomplished by the WRAP team. The state has developed 13 demonstration project proposals which are now being evaluated. Plans are now in operation to attempt one major land use project with others to be added later. In late April, agency representatives from Montana participated in further training.
  5. Other States: The WRAP team is currently in negotiations with other states in the region. From these negotiations, training and project planning will occur and increased activity is expected. By identifying a focal point in each state, the WRAP team will be better able to coordinate overall planning with each state, as well as develop dialog and communication links.
- D. Summary Reports to NASA Headquarters - Ms. Phoebe Williams, Director of User Awareness at Ames, has been developing a series of monthly activity reports. These reports go directly to NASA Headquarters in Washington, D.C. on all activities of the WRAP.
- E. Conference of Remote Sensing Educators (CORSE) - In June, 1978, the grant, WRAP, USGS, and others will hold a conference for educators in remote sensing. The main goal is to "promote the teaching of remote sensing at universities, colleges, and other academic institutions."
- F. National Council of State Legislators (NCSL) - Tahoe Conference - As an on-going program of coordination between WRAP and its service area, WRAP and NCSL co-sponsored a conference at Tahoe on remote sensing. Various representatives of WRAP outlined the objectives and goals of their program and explained the need for legislative support.

- G. MATE (Mobile Analysis and Tele-communications Experiment) - MATE will give state people a chance to find out whether they can use remote display terminals in different locations interacting with a Landsat image processing computer in a central location. The WRAP team is supervising the use and deployment of the MATE throughout the 14 western state region.

SUMMARY -- All of the above are highlights of the WRAP program and the grant's personnel involvement in those activities. There are many others that are in progress and relate to one or more of the above. The WRAP program relies on the "model" activities developed in Northern California and incorporates those processes into their operations with other areas.

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Goals and Objectives	Number of Activities
1. Interact with the Pacific Northwest Regional Commission's Land Resources Inventory Project.	11
2. Create, design, and implement a model for remote sensing technology transfer in Northern California.	26
3. Transfer and disseminate knowledge of techniques and applications of remote sensing.	16
4. Transfer and disseminate information and findings to the 14 western states region, and nationally	26
5. Establish and test a working communications model within the 14 western states region, and nationally.	22
6. Establish an innovative and effective documentation system and test that system as used in the demonstration project, and in the 14 western states region.	13
7. Establish and document communication links from the project to decision makers, individually to decision making bodies and processes at federal, state and local levels.	13
8. Formulate a series of recommendations and guidelines to incorporate all of above items and include other key elements for analyzing implications of the use of remote sensing as an information gathering and analytical tool.	26

Activity	Goals and Objectives								Barriers Addressed								Participants Identified		
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8			
I. Student Involvement--	A	x	x		x				x	x		x	x			x	x	120	
	B	x	x	x	x	x			x	x		x	x	x	x	x	x	65	
	C		x		x				x	x		x	x	x	x			7	
	D		x	x	x	x	x		x	x		x	x	x	x	x	x	30	
	E		x		x	x			x	x		x	x	x	x			300	
	F	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	2
II. Faculty Involvement--	A		x	x	x	x	x		x	x		x	x	x	x	x		52	
	B	x	x	x	x	x	x		x			x	x	x	x	x		7	
	C	x	x	x	x	x	x		x	x		x	x	x	x	x		2	
	D		x	x	x	x			x	x								12	
	E		x		x				x	x					x	x		-0-	
III. Community Involvement--	A-1*		x		x	x			x	x		x		x	x	x	x	286	
	A-2*		x		x	x			x	x	x			x	x	x		167	
	A-3*		x	x	x	x			x	x		x		x	x	x		634	
	B	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1,900
	C*		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		200
	D*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	15
E		x		x	x			x	x		x		x	x	x			17	
IV. Training Programs --	A*		x	x	x	x	x	x	x	x		x	x	x	x	x		135	
	B*		x	x	x	x	x	x	x	x	x	x	x	x	x	x		126	
	C*		x		x	x			x	x		x	x	x	x	x		179	
	D*	x	x		x	x			x	x		x	x	x	x	x		173	
V. California Activities -	A*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Unavailable	
	B*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	"	
	C		x		x				x	x		x	x	x	x	x	x	"	
VI. WRAP Program *		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Unavailable	
TOTAL		11	26	16	26	22	13	13	26	25	11	24	20	23	24	23	9	4,417	

\* Activities which were instrumental in identifying and formulating conclusions discussed in the summary/conclusion of this report.

## TECHNICAL SUMMARY

NOTE: A full technical review will be completed after September 31, 1978. This summary represents a brief overview of major technical accomplishments to date.

The Project staff has advanced a greater understanding of remote sensing technology along two major fronts: the university and the community. There has been a positive effect on Humboldt State University students and teachers. The 120 students taking the class, "Remote Sensing of the Environment," have been exposed to the influence of working professionals in remote sensing through the grant's visiting lecturer program. This has enabled them to see the relative advantages of enhancement vs. digital analysis techniques, high altitude aircraft vs. Landsat, thermal vs. reflective techniques and many other methods. The illustrations and case studies brought forth by these individuals have provided a unique learning experience for the students. About thirty students have also had the opportunity to view the computer terminal hook-up to Ames in a live demonstration of unsupervised classification techniques. This should repeat each time the class is offered (scheduled for twice per year).

Of course, many more students have been at least exposed to remote sensing. These have begun to realize the difference between Landsat digital and color-IR photographs as they have viewed the library displays acquired by the grant staff. A few students (8 to 10) have become more deeply involved in graduate studies using remote sensing. They have been helped tremendously by counseling with the grant staff about every aspect of remote sensing from ordering data from EROS to discriminating spectral classes using Landsat.

All of the faculty have been at least influenced by the grant activity and understand a little more about remote sensing. Nine instructors have or will shortly receive further training. Remote sensing has and will be presented as a useful tool to be used in a fully integrated approach to resource inventory. These faculty understand how Landsat may help in overall stratification, or primary sampling unit description. They know how the U2 and low altitude aircraft also fit into the picture as sampling tools for maximum cost efficiency. They have and will also learn the basics of Landsat digital analysis, contrast stretching, supervised and unsupervised classification techniques, digitized summary strata and various output products. By the end of this summer, these faculty members will be able to intelligently include remote sensing as a useful inventory tool in their courses and professional activities.

The emphasis on further remote sensing education at Humboldt State will stress integration of remote sensing as an inventory tool. A new course in inventory design may be taught in the School of Natural Resources. This class would stress remote sensing techniques from aerial sketch mapping to Landsat digital analysis showing the most beneficial application of each or all in a multi-level approach. This is one of the ideas proposed by the Natural Resources Curriculum Committee.

The major technical effort in the community is the U.S. Fish and Wildlife Service Demonstration Project on the Hoopa Indian Reservation. Ken Mayer and Jeff Soto (a cooperating graduate student) have received extensive training in Landsat data analysis applied to vegetation mapping. The approach was initially unsupervised using the ARPANET/Editor system to classify a portion of a Landsat scene into 20 spectrally distinct categories. Using L<sup>2</sup> maps, dicated color coded prints and U2 photography, these two men have evaluated the classification. They are now using supervised techniques and guided clustering to establish valid statistics for the information classes they need. It is through this often painful and frustrating process that most of the truly technical expertise is being learned. A final session at Ames will take place in the near future to evaluate all of the statistics generated and arrive at a final classification. Most importantly, the day-to-day work on resource category description is being done by remote terminal at Humboldt State University, providing a level of independence from Ames never before realized.

Gary Rankel (Ken's supervisor and a fisheries biologist with the U.S. Fish and Wildlife Service) has been kept up to date on all phases of the project. He has seen the raw data, partially classified data, and will be thoroughly briefed on the final product. Because he has been involved from the beginning, he will understand the final map thoroughly and be in an excellent position to explain the benefits of satellite remote sensing to his co-workers and supervisors. Of particular technical importance is the relationship of this project to the overall project of the Trinity River Task Force.

Several other working professionals in the U.S. Forest Service, California Department of Forestry, California Department of Water Resources, and many other agencies have been given a technical orientation to the technology. Through specialized workshops and training sessions, the staff at Humboldt State University has helped these people understand the most efficient use of the various remote sensing platforms available. Most importantly, they have seen Landsat at full resolution (say 1:50,000) in combination with standard topographic maps. This kind of approach will help them see high altitude remote sensing in its proper light. It is a system to be integrated with other techniques but also will stand alone in the ability to display resource categories in a clear way with sufficient working space (large enough scale) on the final product to make it a tool and not a wall decoration.

The overall technical achievements have been impressive. The Humboldt State University effort is only limited by full time technical coordination. It is considered that with the addition of both the Bendix MDAS equipment and by activating use of Humboldt State computers (part of CSUC Computer system) to process Landsat digital data as part of academic/instructional program, that full time technical coordination will automatically come about.

This is a major problem that will be addressed as part of the technology transfer to the university during fiscal year 1979.

## CONCLUSIONS

Several practical and useful conclusions have been drawn from analysis of the last year's activities. These conclusions have been prepared from Project staff examination and evaluation of nearly 2,000 pages of notes; evaluations of countless workshops and presentations and the priceless input of hundreds of community members, agency personnel and friends of the "space" group.

It is clear to all involved in the Northern California project that whereas much work needs to be finalized and supported by NASA in the next year, that practically, we are truly heading towards the goal set several years ago. That goal is a regional appropriate technology center, which will work with a variety of technologies, some coming from NASA, some from other areas.

We have utilized our technology transfer model building efforts to the fullest extent and can demonstrate the next steps that must be taken. The following conclusions will form the background and basis for our fiscal year 1979 proposal, which should, at its conclusion, end NASA support and see the region launched into an appropriate operational status.

The major conclusions are as follows:

- There is a resistance factor in most all agencies to accept a change from traditional methods of data acquisition, reduction and analysis. This resistance factor may well be overcome slowly and gradually by building confidence in the new technology. The gradual change must be facilitated by multiple exposures to the new technological tools, and by a regional advocate known to and trusted by the users.
- There is an "upside-down" syndrome being developed by NASA's natural eagerness and enthusiasm to "sell" Landsat technology. Lip service is being given to the need for integration of the satellite data with conventional data and tools, but no real up-front effort has been made by NASA to make sure users are aware of what else is available. This appears to be a serious oversight, since familiarity with what other conventional tools (such as the wide variety of USGS-Geography, GIRAS, LIA program materials) most often has lead (in our experience) to a greater understanding of how Landsat data can work for them. The idea is to help users get the right tool to fit the task at hand.
- There is a strong need for local or regional "arms" of the NASA ARC involved in the WRAP. Most state and local agency personnel are so busy and travel budgets so short, that the needed multiple extensive training courses, often tedious human interaction with

computer, calculator and light table, cannot take place as they should. This results in projects being shortcut, abandoned or poorly done. Day to day liason must be performed on a local basis to insure good results and hence, real technology transfer.

Furthermore, NASA ARC cannot respond to small localized projects due to distance from such projects, time and lack of people resources to respond. A localized "arm" of NASA ARC, such as the Northern California Project team, can easily respond to such localized needs, and at nominal cost.

- Users or potential users have a strong need to know that their problems and projects can be approached in a timely fashion. Dependence upon the uncertain or limited resources currently available within NASA ARC has led to uncertainty and confusion within various agencies desiring to get involved. Furthermore, numerous entities in the Northern California region are not really interested in demonstration projects per se. They are interested in doing actual projects in a semi-operational mode and simply need help to get started. A local or regional arm for NASA ARC, by providing support to numerous small but semi-operational projects and relying on regional resources, will insure real integration of the technology into operational programs.

In the near future, this type of "arm" can transcend into a permanent technology assistance center, which would be totally funded from sources other than NASA.

- There is a strong need to be sure that the projects and programs under WRAP or RAP, in general, truly fit the locality or agency from which they arise. Certain of these projects may cover only small land areas, but will provide important individual components of a regional data base. This "data base" concept needs to be carefully developed and must be brought to the users attention early in the game.
- There is a powerful need to train and educate the "legislation-forming" strata in state and local government, regarding the use and application of remotely sensed data. This "strata" may not, in fact, be the legislators themselves, but legislative aids, research analysts, interns, etc. The strata must be more clearly defined and an organized attempt made to set up training workshops and initiate information flows to all within this strata. At present, there appear to be no recommendations or stipulations to use specific tools in implementing work plans attached to legislation that affect natural resources, as a result of lack of information at the "legislation formation" level.

--There is a strong need for information and education about uses and applications of remotely sensed data to be extended to all American Indian tribes. American Indians own a startlingly large percentage of the total land mass of the United States. Recent trends indicate that, more and more, Indians will resume control and management of their own lands. By the nature of the changing role of these citizens and their often remote locations, they are prevented from knowing about or using even conventional and traditional resource management tools. Therefore, the needed education and information should include several sections on the nature of resource management, conventional management tools and resource data collection, as well as sections on remotely sensed data collection and appreciation.

--A most critical need is the early resolution of the "experimental Landsat" problem. It is difficult to honestly tell users they are absolutely assured of getting satellite data for extended periods of time. Often, the repeatability component, along with well documented and archived satellite data records is the single most attractive feature to potential users.

In attempting to determine the status of this difficult theme, it was observed that certain critically needed and very basic background information does not exist that decision makers could plug into their deliberations. Among the basic information needs is a detailed survey of what actual data users there are, how the data is being used, and what data collection needs to be repeated on a regular basis, either by federal, state or local legislation, or by practice. This survey should be on a state by state basis.

--There is a powerful need for NASA to encourage and assist development of a wide array of remote sensing technology transfer institutional mechanisms. Key among these is the transfer of a remote sensing capability to universities and community colleges so these institutions can begin assuming their role in training and educating students and community users. The traditional "research lab" must not be abandoned in the rush to "transfer technology," since much research remains to be done in on-coming satellite programs and systems. But certainly, there must be clear definition with and to the universities as to their role in research versus transfer of technology.

--There is a growing need to direct a major communication effort regarding the technology of remote sensing (and the possible peripheral "spin-offs" and related business opportunities and advances) to industries. These industries should not be those particularly of or closely related to aerospace, but small businesses and industries which deal with sale or distribution and development of land, natural resources, etc.

## SUMMARY

The past twelve months have seen dynamic results from wise use of NASA "seed" dollars in the Northern California Remote Sensing and Technology Transfer Project at Humboldt State University. The grant, while broad in its scope, has effectively provided the Northern California community with the means to create, design and implement a strong working model for remote sensing technology transfer.

From the beginning, the Northern California group has utilized a three-part approach, essential to a comprehensive transfer program, including the university and community college, the "community" at large, and potential/actual direct user agencies, primarily state and local.

Each of three areas of approach, using the specific activities described in this document, have addressed the eight stated goals and objectives, and in multiple ways. Each of the stated eight barriers to technology transfer was recognized as an initial guideline, which in removing, helped to achieve the goals and objectives. All project activities were designed to help remove traditional constraints, whether real or implied, that have hampered technology transfer efforts in the past.

The model, designed to serve local, regional and national needs, is still in a formative stage, needing further development, testing and evaluation before transfer to an operational mode.

Analysis of the activities and accomplishments within each of the three major transfer effort areas has identified quite accurately the essential next steps.

These steps are, during fiscal year 1979:

- Complete transfer of a remote sensing capability to Humboldt State University.
- Support Northern California (as defined) demonstration projects.
- Conduct a 14 western states user survey (using "California survey" format).
- Conduct two major workshop series:
  - \* Small business - Industry (Northern California) "Remote Sensing Opportunities"
  - \* Indian Tribes - Resource Managers, "A New Approach to Reservation Resource Management" (WRAP Region - Cooperators would be: BIA, Indian Tribes, University of Oklahoma, USGS Geography Program, Humboldt State University, NASA WRAP)