APPLICATIONS OF REMOTE-SENSING DATA IN ALASKA

A Cooperative Program of the University of Alaska with User Organizations, Including Local, State and Federal Government Agencies

ORIGINAL CONTAINS
COLOR ILLUSTRATIONS

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INTRODUCTION

Even more so than the private sector, agencies of federal, state and regional governments have an increasing need for detailed information in areas related to natural resources for policy formulation, program development and evaluation of results. Events in the national and international economic scene have focussed attention upon the exploration and development of natural resources, and particularly those related to energy production. The development of additional domestic sources of energy is a prime objective of the United States in this decade. There are compelling indications that vast oil and gas reserves exist offshore along the northern, western and southern coasts of Alaska. An assessment of the sometimes conflicting activities of divergent types of resource development requires a complete knowledge of the environmental setting so that each may be sensibly exploited while preserving most of the values that are important to the others.

The inventory and management of natural resources over vast areas lend themselves effectively to the application of remote-sensing data, especially where very divergent interests are involved such as is the case in Alaska. A goal of this grant is to develop these opportunities for satellite and aircraft sensor technology.

Petroleum exploration and development offshore and onshore have a profound effect upon the adjacent land and its people.

This is especially true for the confrontation in Alaska between the extractive industries and the tiny socio-economic structure of native villages in areas facing imminent development. Remote sensing of the environment is a tool to help manage and control this development in a timely fashion so that divergent interests can fit reasonably well with those values which best serve the indigeneous people, the nation, the land and sea and the total resources of the region being impacted.

The Coastal Zone Management Act, the Alaska Statehood Act, the Alaska Natives Claims Settlement Act, the National Environmental Policy Act, and the Federal Water Pollution Control Act Amendments are examples of legislation on the federal level which are generating increasing demands for information relating to natural resources. Some vital state interests involve future oil and gas lease sales being planned for the Outer Continental Shelf (OCS) by the federal government (BLM) or by the state in state-owned offshore waters, or a joint effort by both the federal and state governments. These lease areas include the Gulf of Alaska, Lower Cook Inlet, Beaufort Sea, Bering Sea (Norton Sound), Bering Sea (St. George), Outer Bristol Basin, Aleutian Shelf, and Chukchi Sea.

The environmental issues involved with these proposed sale areas are complicated by conflicting interests. On one side the federal interests generally favor early dates for lease sales by 1978 in the order of most promising potential for petroleum discoveries. On the other side the State of

Alaska prefers a reordering of sale areas which takes into account the ability of on-shore communities to adequately plan supporting facilities for exploration and development activities. The state also prefers a lease schedule which is considerably lengthened into the 1980's to allow communities additional time to obtain information and plan for the onshore impacts.

State agencies such as the Department of Environmental Conservation, the Department of Fish and Game, the Department of Community and Regional Affairs, the Department of Natural Resources, the Department of Commerce and Economic Enterprise and the Department of Revenue are being directed by the administration to define a state position on a modified leasing schedule based upon analysis of environmental, technological, and socio-economic data. The need for a rational basis for both the ordering and the timing of the nine OCS lease sales should generate opportunities in the coming years to apply remote-sensing techniques to support State interests in some of the onshore areas to minimize the impacts and to draw upon the possible benefits of OCS leasing activities.

Three factors are being studied relative to the revision of the leasing schedule:

1. the present and future economic benefits from oil and gas leasing (both public and private)

2. the present and future national energy and petroleum needs

3. the minimum environmental and social impacts that can be associated with petroleum exploration and development offshore.

The revised schedule for lease sales which will be strongly backed by the State of Alaska will be only one aspect of the overall state position. Consideration will also be given to stipulations in the announcement of lease sales that long-range analyses shall document the reasons that the sale will minimize social impacts on the public.

Oil and gas resources are vital to the nation and valuable to the state, and they will be developed. Fisheries resources are equally vital and are needed to feed people in Alaska and throughout the countries of the Pacific rim. Most of Alaska's prime timber resources are concentrated in coastal forests and are required for expanding urban developments. Prudent management of coastal resources involves the siting and timing of production activities to utilize these resources without undue impact upon resources which compete for stability in the same ecosystem space. Decisions will have to be made by appropriate agencies to locate oil and gas facilities away from critical habitat and consolidating transportation routes into common corridors. These decisions will not be restricted only to state and federal entities, but will require that the state, federal, regional and local agencies work together to find common solutions rather than fragmented and conflicting approaches.

The development of the coastal-zone-related issues is generating an increasing need for information which is greater in quantity of natural resource data, greater in quality of detail of data, and more frequent collection of data owing to the need to monitor certain aspects of programs. The array, detail and frequency of information acquisition required to develop natural resources and to implement and maintain the resulting programs demands improved techniques of data gathering, processing and interpretation which is conducive to the use of remote-sensing techniques. As Alaska, both in the state and federal domain, gears up to meet the energy-related issues facing the nation there will be a growing role for efforts which adapt state-of-the-art tools to solving existing problems.

SUMMARY OF ACTIVITIES

There is a need for increased awareness by the user-agencies of the current technical capabilities of satellite remote-sensing, the various ways of applying this technology, and how the agency can train their own people to use the new technology. Well-established communication links between the University and the users is the key to effective utilization of remote sensing by a wide sector of public and private organizations. Each user should be aware of other uses of satellite technology to be able to benefit from the successes and failures of similar efforts elsewhere.

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After years of minimal responsibility for management of the natural resources in Alaska, there is a growing opportunity for State involvement in programs designed to protect, manage, and develop natural resources. Decisions that must be made as the State exercises its new prerogatives of more self-determination requires access to large amounts of data which describe existing patterns of the distribution of natural resources. Such data are also needed to define models which can serve a predictive role to assist in the formulation of alternative policies designed to protect, manage and develop these resources.

The recent need for resource information on the State level of government is also supported by a growing number of federal programs that require State planning and regulation of various environmental aspects. Concurrent with this rapid acceleration in the demand for more resource data, there also has been rapid developments in the field of technology, such as remote sensing, which can aid the acquisition and processing of data pertaining to natural resources.

The use of natural resource data, including remote-sensing techniques, is not exactly new in the State arena. The Alaska Department of Highways has used these techniques as aids in siting and constructing roads based upon data relating to topography, load-bearing capability and stability of soils, engineering geology, and existing land uses. Managers in other agencies concerned with environmental conservation, land resources, fish and wildlife have also used data extensively for their decision-making processes and operational activities. However, it is the gaps that exist between the data that these managers need and the data that they have available to them that provides a driving mechanism for the activities related to this grant.

The importance of an adequate base of data on natural resources probably cannot be overstated. However, it would be a vast oversimplification to imply that a good data base will result in a good management decision, or that an inadequate data base will preclude good decisions. There are far too many other factors involved in the policy level and program implementation level to assign credit or blame to the adequacy of the supporting data base. At the same time, the availability of accurate, timely and relevant data describing natural resources contributes materially to better decisions in relating to the technical aspects of the resource problem being addressed.

Interestingly, the greatest need within an operational or mission-oriented agency for detailed data occurs primarily at the lower levels of implementation. The manager who determines the allowable uses and minimum sizes for parcels of land requires more specific and larger amounts of data than does the planner who establishes the broad goals of a land-use plan. Since remote sensing is especially applicable to activities that require large amounts of detailed data, our work has emphasized an effective liaison with many mission-oriented agencies at the operational level. A consistent, interactive channel of communication is essential to recognize the opportunities to apply satellite technology to agency problems. Such communication implies that we remain cognizant of the changing needs of agency activities as well as agency officials remaining aware of the changing technology. The needs for information differ at the policy and program implementation levels, and we must take particular care to meet these differing needs in appropriate ways.

The University's role as a functional base for the applications of remote-sensing technology to all users of Alaskan data has become well known. We continued efforts to expand the utilization of satellite technology that is appropriate to problems in the management of Alaskan resources. We seek involvement in cooperative projects which promise beneficial applications of remote-sensing technology, particularly satellite sensing, to agencies with operational problems to solve. Emphasis was given to those projects which had a good likelihood for significant decisions being made which were based upon the results of the activities supported by this grant.

While most of our efforts were oriented toward specific projects, performing an operational project successfully requires supporting facilities and capabilities. Included in our activities was a general outreach effort which served to alert us when opportunities for new applications occurred, a data library and laboratory to generate the basic products that are required, and processing facilities to manipulate the data into suitable forms for analysis, interpretation and application.

Coordination and Information Exchange

We have maintained a statewide liaison with operational agencies of government and industry to maximize a sharing of appropriate levels of information. We enjoy a substantial base of goodwill and rapport with various user groups involved with environmental and resource management problems. We are generally recognized as the best source in Alaska for information on remote-sensing technology and for suitable data products.

Many agencies are using our capabilities to a growing extent. The utility of these applications is borne out by the many user-agencies which have borne a major share of the cost of their data applications. When appropriate circumstances prevail, funds from this grant were used to support the demonstration component of cooperative projects with user-agencies. This policy was intended to overcome reluctance by the users to perform what can appear to be research or feasibility studies, when the agency may be constrained to support only operational activities.

Data Library

An important service to the community of users within Alaska is the publishing of information catalogs and listings of available Landsat and aircraft imagery. While most data are available from national data banks, we archive the Alaskan data with low cloud-cover which are most relevant to Alaskan needs. Because of the huge geographical extent of the State of Alaska, and delayed response times, it is impractical to rely on data searches conducted by national data centers. Users have an immediate need to know what data are available when gathering information for problem-solving. Part of our coordination effort includes the distribution of catalogs which meets the user's need for browsing among available data or searching for some specific regional coverage. Our current catalog of Landsat data appears in Appendix B. As the body of locally stored data grows, maintaining an up-to-date bibliography of the total Alaska library will remain an important part of our activities.

The flow of non-Institute visitors to our library facility for satellite and aircraft images and digital tapes has gradually increased over the past several years to an average of 70 per month. These visitors come to examine and select data products and order reproductions which cost $1,500 per month. These orders for data are either handled by our own photo lab on a job-order, cost-reimburseable basis or the orders are consolidated and transmitted to the EROS Data Center, Sioux Falls, South Dakota. Additionally, these visitors engage the photographic display and enhancement facilities which were co-located with the library in Room 208 of the C. T. Elvey Building. One or two visitors with relatively trivial needs could be partially accommodated, but others were forced to stand in the entryway.

The activities of this grant over the past several years have shifted from training and consultation to participation in demonstration projects which require extensive analysis and interpretation of many forms of data. The activities of outside visitors and our own project requirements had saturated the existing 700 ft^2 working area. The flow of data products from Landsat and NOAA satellites and from aircraft occupies thirteen file cabinets and thirty feet of shelves around the perimeter of the library, and the magnetic tape storage has already overflowed into a large tape-storage cabinet next door.

Upcoming new projects made the existing library critically inadequate in view of the need for controlled, low-level illumination for light tables that are conveniently located near the stored data. Such lighting is incompatible with normal library and browse activities. The inevitable expansion of the remote-sensing data library, which is the focus of much of our initial contact activities and outreach efforts to users, forced a reassignment of room space within the Geophysical Institute. At no cost to this grant, Room 211, adjacent to the previously used Room 208, was remodeled for use as a data-analysis room. Shelves and a large working counter with a built-in, 8' light table were added around half the perimeter of the room for ease of working with data products. This added room also housed the Zoom Transfer

Scope, Color Additive Viewer, stereo zoom viewer, and microfilm reader. This enlarged facility was a major improvement in support of these grant activities and was accomplished completely by State funds.

The operation of the Landsat library frequently involves consulting services of at least four types:

(1) Assisting the user in selecting the data which have the greatest potential of satisfying his needs.

(2) Assisting the user in preparing orders for standard data products from the EROS Data Center. This is particularly appropriate when the need for data is not immediate and standard data products are satisfactory for this purpose.

(3) Assisting the user in preparing a local work order for custom data products (images enhanced for the purpose of the investigation, density-sliced images, etc.).

(4) Advising the user on data analyses and data interpretation facilities available either locally or at major laboratories outside Alaska.

The Landsat data library, browse file, and associated consulting services and facilities remain an essential activity to provide applications assistance to all data users in Alaska. Part of these activities were supported by

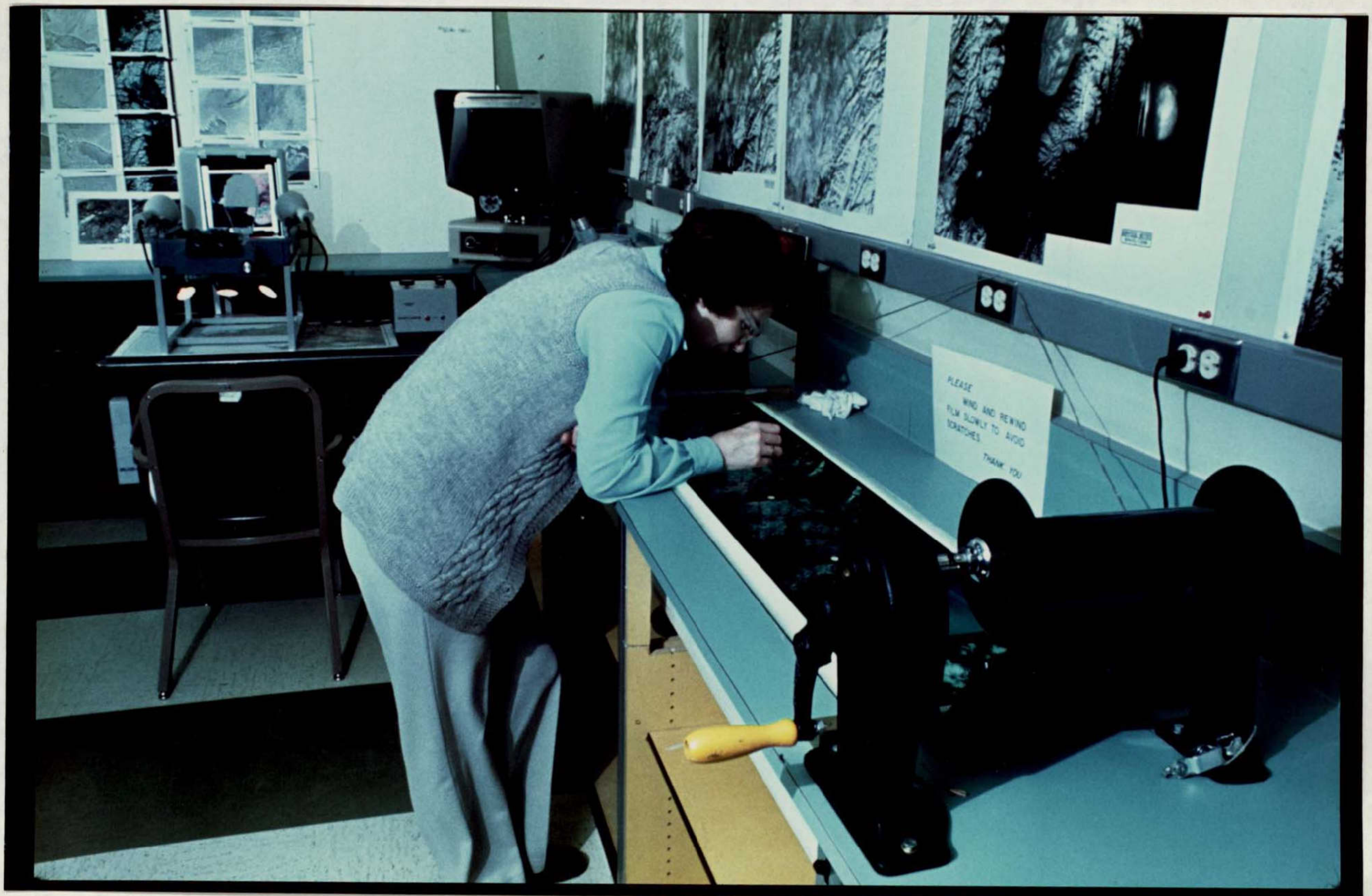

Figure 1   Landsat Library
Remote sensing data library facility receives about 70 visitors per month, requiring assistance over the entire spectrum of remote sensing applications.

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a contract with the U. S. Department of the Interior, EROS Program Office, for a librarian. There has been an increasing amount of data purchases ordered through our library, which is indicative of the interest and practical value being placed on remote-sensing data by Alaskan users. Further evidence of a healthy, self-generating flow of applications is that we recorded around 70 "walk-in" visitors per month. This demonstrates that there is a growing community of somewhat self-sufficient data-users which has resulted from our efforts to find new applications for remotely sensed data.

Data Processing Services

An essential aid to new users of remote sensing has been the services of the centralized facilities for processing remote-sensing data at the University. It would be wasteful were each user agency to establish laboratory facilities and technical personnel to perform its own analysis and interpretation. A continuing activity of the University was the processing of remote-sensing data either photographically or digitally to the specifications of the user agencies. These activities were performed on our facilities on a job-order basis parallel to the applied research already under way. In most instances, the user agency bore the costs of such direct services, but selected cases with high benefit/cost potential or demonstration projects were funded from this grant for direct services support.

The ability to provide a variety of processing services for the data is equally important as the timely access to specific data to produce a satisfied user. This enables the user to receive the data in a format best suited to his particular application, rather than "make do" with those standard data products that are available. Data processing for its own sake has not been supported by the grant, except for those cooperative projects which otherwise qualify for funded support.

Our experience and the published work of others has shown that the more substantial applications involve not only conventional photo interpretation but increasingly use computer-aided digital techniques of analysis and interpretation. Some of our users are tending to move from visual photo interpretation into the application of digital interpretation techniques.

It is often necessary to reconstitute an image from the processed digital data in order to convey information required without the use of color. A digital-image recorder with the capability of reconstituting color products was procured and installed this year using State of Alaska funds appropriated to the University of Alaska Geophysical Institute. Basically it is a rotating-drum film recorder which produces four simultaneous images on film up to 8x10" in size. Density resolution is 255 levels of gray, and spatial resolution is 500 lines per inch. Recording rate is 1.5 lines per second. Any combination of the four negatives so produced can be

Figure 2   High resolution digital image recorder used at the Geophysical Institute to make film products from Landsat digital data.

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registered and printed with suitable filters to produce a reconstituted color negative to be processed and enlarged photographically.

The image recorder has been extensively tested to improve its performance. Density levels between the four channels were adjusted to achieve precise balance needed for consistent color generation. Several different film and processing combinations were evaluated to determine the optimum method of reconstituting color products from black-and-white separations. Testing has been completed and we are now able to obtain photographic images in color with high resolution and maximum detail from digital data products. The computer-aided classification map, Figure 3, is an example of a color-coded thematic map prepared by the new digital recorder.

Applying digital techniques with our present facilities is uneconomic except for very small target areas. This results from the original design concept of our digital color display unit which was intended to serve only limited test-areas associated with our early ERTS-1 feasibility investigations. It is now evident that we cannot adequately serve the needs of our community of data users without a greater capability to process larger quantities of digital Landsat data. Several projects have required moderately extensive, computer-aided analysis techniques which were beyond the capability of our in-house services and for which we sought processing services from firms in the contiguous states.

Figure 3 Color-coded thematic image of the Baldwin Peninsula, N.W. Alaska, produced from digital Landsat data on IGOR, a high resolution digital-image recorder.

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Procurement of outside computer services is an interim solution until we can develop a local capability of performing clustering and maximum likelihood algorithms on a scale suited to users of regional analyses. The awkwardness of interaction and communications with service firms in the lower 48 states, while dealing with complex data handling and processing decisions, greatly extends the time and cost of a given project. In some instances it has meant the untimely end to an opportunity that otherwise deserved our involvement, which is counter-productive to the objective of this grant. Consequently, for projects of larger scope, we must give preference to those which do not demand a short turn-around time.

It is very unfortunate that we have not been able to add the hardware and software required to do the kinds of work required by Alaska's users of remote-sensing data. Not having the facilities at hand to perform digital analyses is a severe handicap which we must continue to accept while we seek other support for upgrading our basic capabilities. This handicap seriously impedes our participation in demonstration projects which should be designed to represent (when appropriate) the state-of-the-art techniques of satellite remote-sensing. Cooperative projects of a demonstration nature become tougher and more awkward under the constraints of few capabilities for processing digital data and under the guidelines of this grant which is devoted to applications rather than development of facilities.

We have discovered that one of the greatest hindrances in generating truly effective demonstration projects with an operational impact in the user organization is the lack of timeliness in completing the necessary data analysis. Most mission-oriented agencies at the implementation level require prompt answers. It may not be the mode we prefer, but many times an urgent need is perceived so far downstream in the sequence of events that thorough, systematic planning by the agency is impossible. In such instances, the agency typically will approach us in hopes that some last-minute miracle from space-age technology may save the day. If digital analysis of satellite data is an obvious preference for a given project we find that organizations which offer these services "outside" entail delays that are intolerable to the user. Such inability to respond with an experimental technology (Landsat) to meet the time constraints of operational applications is a fault of the mechanism for the delivery of technological benefits, not the technology itself. To an extent we contribute to the ineffectiveness of this transfer process by our lack of capability to process digital data. This defect we will seek to remedy in due course and to substitute in the interim perserverence and ingenuity to achieve a measure of in-house analysis of digital Landsat data.

Training and Workshops

We have not emphasized formal courses in basic principles of remote sensing this year. Efforts in previous years have established a rather broad foundation in the theory and application of remote-sensing techniques. The past few years we have tried to concentrate more heavily upon groups that sought our help in training or educational exercises. These included informal indoctrination of individuals from agencies as well as participation in formally structured workshops tailored toward specific operational needs of the agency.

The National Park Service requested our assistance in conducting a workshop devoted to interpretation of Landsat imagery for ten NPS staff members. Approximately one-tenth of Alaska's land area has been proposed before Congress for withdrawal into the national park system. In order to plan effectively for the development and utilization of these potential park areas, the NPS established a planning and resource-evaluation team in Alaska. The membership on the planning team represents disciples as diverse as mining, engineering and archaeology.

NPS was attracted to the opportunity to use satellite remote-sensing techniques in the areas to be studied because they are so large. Because of our familiarity with the use of Landsat data, NPS asked us to provide the personnel and facilities to conduct a one-week workshop to demonstrate the techniques of photointerpretation of Landsat images, and to supervise the trainees in preparing land-use maps of special areas of interest. Many of the maps produced during and subsequent to the workshop will be used as supporting data during internal reviews within NPS and for presentations to

Figure 4 National Park Service Workshop
NPS personnel participated in a workshop to use Landsat imagery for planning proposed additions to the national park systems.

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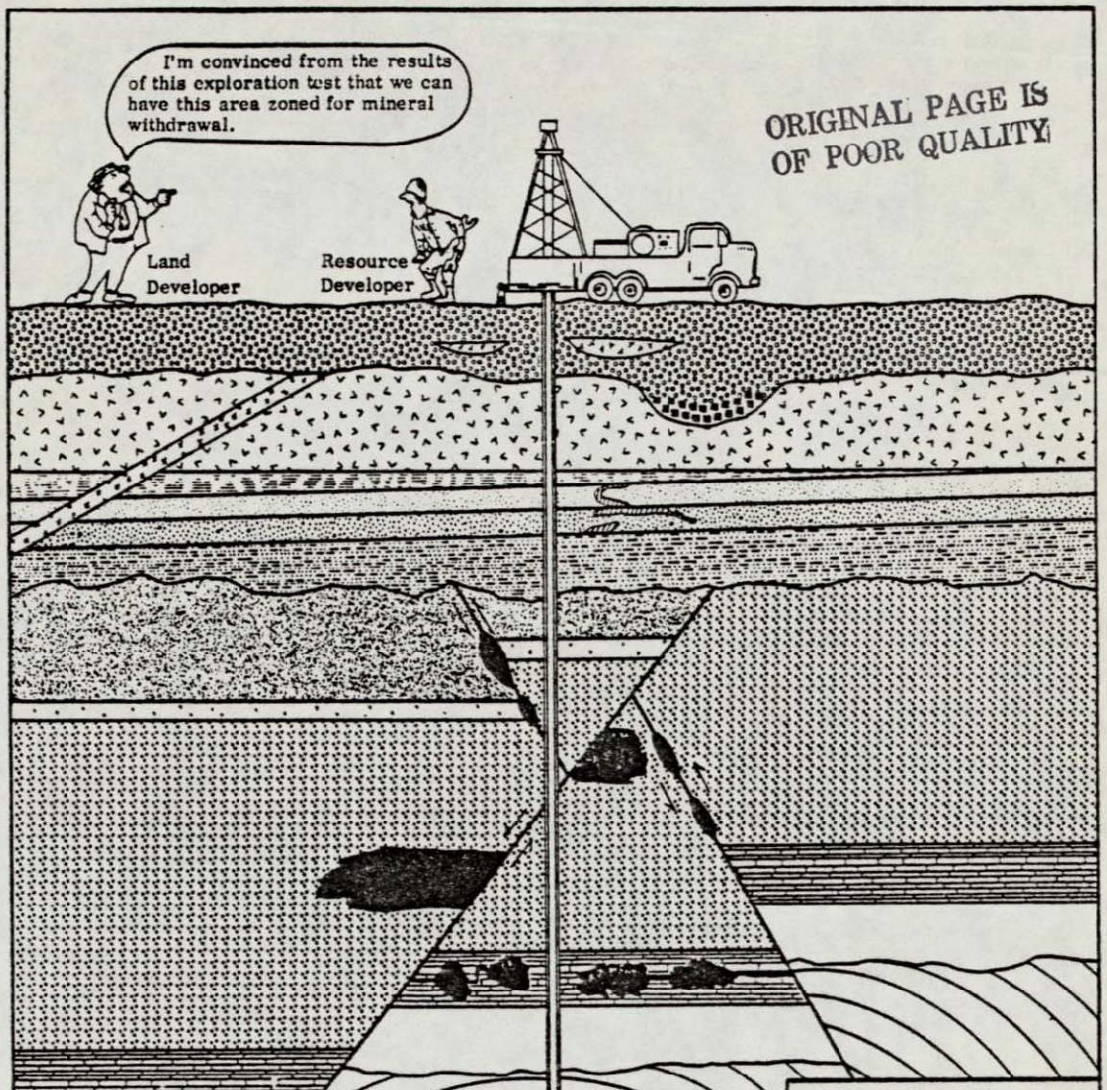
Congress in 1979. Further, NPS committed itself to extend these remote-sensing techniques to land-form mapping of all areas reserved for national parks and the surrounding zones of ecological concern.

Alaskan Needs for Resource Information

The activities supported by this grant are purposely intended to emphasize cooperative projects which will include specific decisions and actions taken that are attributable to the information generated by the project. Such a policy reflects the constraints of the existing national climate which favors relevance in research at the expense of basic knowledge, but to our surprise we are discovering these criteria are not well-tailored to Alaskan needs. The cartoon of Figure 5 illustrates effectively the dilemma that faces Alaska. Stated simply, land-use planning and resource surveys in general are critically important to Alaska; yet, they seldom generate the desired operational activity which is the hallmark of relevance. It may appear that resource surveys come and go without end and seem to disappear into map cases and file cabinets for obscure purposes, if any use is made of them at all. Events in Alaska testify to the opposite condition -- decisions that eventually will be based in part upon resource surveys will inevitably fix the mold of Alaska's future. Further, this mold-making process is underway at this time with an inadequate data base. The



"To reason without data" (or with inconclusive data) "is nothing but delusion."—with apologies to Arthur Holmes. *(From Arizona Bureau of Mines, Sept. 1975.)*

Figure 5
From the "Mines and Geology Bulletin", Alaska Dept. of Natural Resources, Div. of Geological & Geophysical Surveys, January 1976

decision process is highly controversial and will remain an active topic for years to come in all segments of public and private life in Alaska.

The reason for an apparent dearth of action by many agencies at the present time is that although these agencies are concerned with accurate, up-to-date data on resources, they have a mandate to make recommendations to higher authorities -- such as congress and the state legislature -- rather than to take direct action to establish or change existing laws, policies, or regulations. An inability to engage satellite technology with projects which lead only to the intermediate step of generating recommendations is a keen loss to Alaska. The majority of the opportunities for application of remote sensing fail to qualify for grant support because the most likely result that can be identified is a recommendation for a specific course of action to a higher authority where lies the decision-making power. Owing to the many social and political ramifications, as well as built-in provisions of existing statutes such as the Native Claims Act and the Statehood Act, the timetable for such decisions regarding who will do what and when in Alaska covers a period of many years. Such constraints mitigate against results that have immediate payoff and that can demonstrate practical relevance. In these instances the trade-off of seeking short-term benefits from remote sensing at the expense of long-term benefits to the State is very large. The course of many issues now being shaped in Alaska will be measured in terms of events over the next 100 or 200 years. It is unfortunate that satellite technology will play a smaller role in shaping major Alaskan events than the technology deserves.

Cooperative Projects

Whether a potential project can qualify for activities supported in part by this grant is contingent upon our ability to perceive the basic goals of the agency and to recommend an approach which would effectively utilize the tools of remote sensing. These concerns can be focused on several issues:

+ User needs in terms of awareness and ability to use new forms of data
+ Data availability in terms of timeliness and cost effectiveness
+ Availability of facilities for processing and interpreting the data
+ User readiness to take appropriate action based upon the information obtained from the data

Where possible, we have tried to prepare alternative strategies when interacting with agencies in the definition stage of a potential cooperative project. Flexibility which results from this kind of an open-end approach is more conducive to projects which are user-driven in contrast to an approach which tries to match technological solutions with operational problems. Summaries of projects with significant progress this year follow.

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USDI/Bureau of Indian Affairs

This project was technically completed during the previous year, but the actual land selections were not made public until the current report period. Because of the economic and social significance of these results, a detailed description of the background, implementation and results of the project are included here as an overall summary which can stand alone. The technical details of the methods used are described in Appendix C of the Annual Report for the period July 1, 1974 to June 30, 1975.

By the Alaska Native Claims Settlement Act of 1971 (ANCSA), Congress granted 40-million acres to the Native peoples in Alaska with the stipulation that the land be used for the benefit of all the Natives through the mechanism of regional Native corporations. The Secretary of the Interior was directed by the Act to withdraw from the public domain three times the amount of land otherwise entitled to the regional corporations. In effect this created a pool of available land on reserve from which the Native land selections could be made, and in many instances for each acre of land that a corporation selected it was implicitly rejecting two other acres of potential land. The corporations had until December 18, 1975 to make their selections of land based upon whatever criteria they deemed most desirable.

Doyon, Ltd. is the regional corporation formed for interior Alaska Natives, and its boundaries shown in Figure 6 encompass a region that is complicated by existing federal

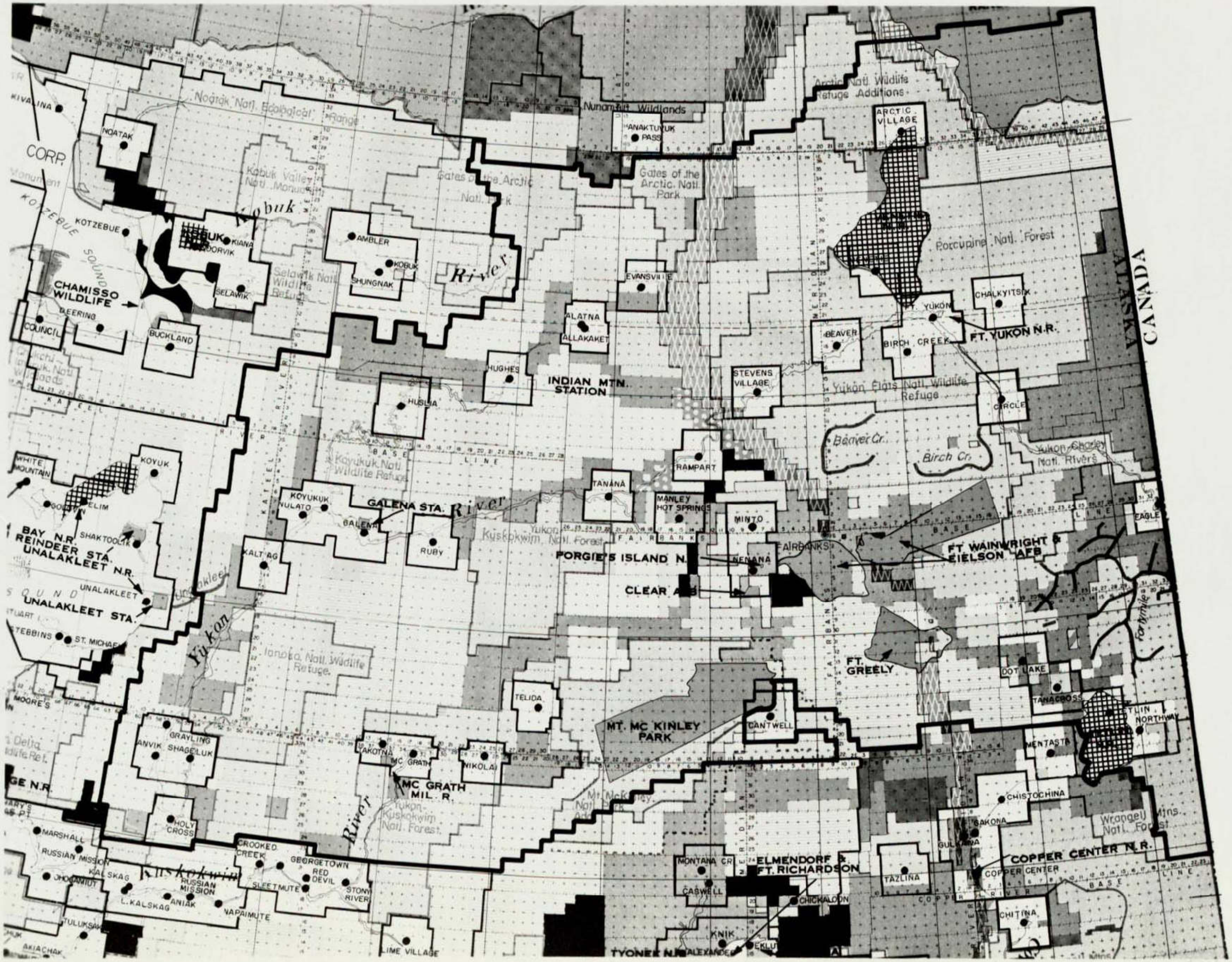

Figure 6 Doyon Region
Doyon Ltd. is selecting lands from this 30,000 sq. mile area of interior Alaska (heavy black line).

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and state land withdrawals, and is three-quarters the size of Texas, varied, far-flung, and which contains a variety of resources such as petroleum, mineralized lands and spruce and birch forests of commercial quality.

The obligation of all Native corporations to develop goals, objectives, priorities and land-management policies is staggering in view of the unprecedented social impact of ANCSA upon areas in which the quality of village life can be characterized as bare subsistence. The Native society in rural Alaska is struggling with the values of a traditional subsistence economy conflicting with those values of a cash economy, but with very few opportunities for earning an income. The attendant human toll on the village inhabitants is of deep concern to Natives and non-Natives alike. Simple answers to these social problems are not at hand, but it appears that the self-determination by Natives with their own resources to manage may be more beneficial than the largess of governmental agencies. ANCSA brings both money and resources into the hands of the Natives and provides the opportunity for rural inhabitants to establish a changing, yet viable, community which is consonant with their cultural heritage.

Figure 7 locates three of the seven regions studied for Doyon with the aid of Landsat imagery -- Kaltag, Purcell Mountains, and Tanana. In each instance resource maps were prepared to emphasize the prospecting and commercial-timber potentials.

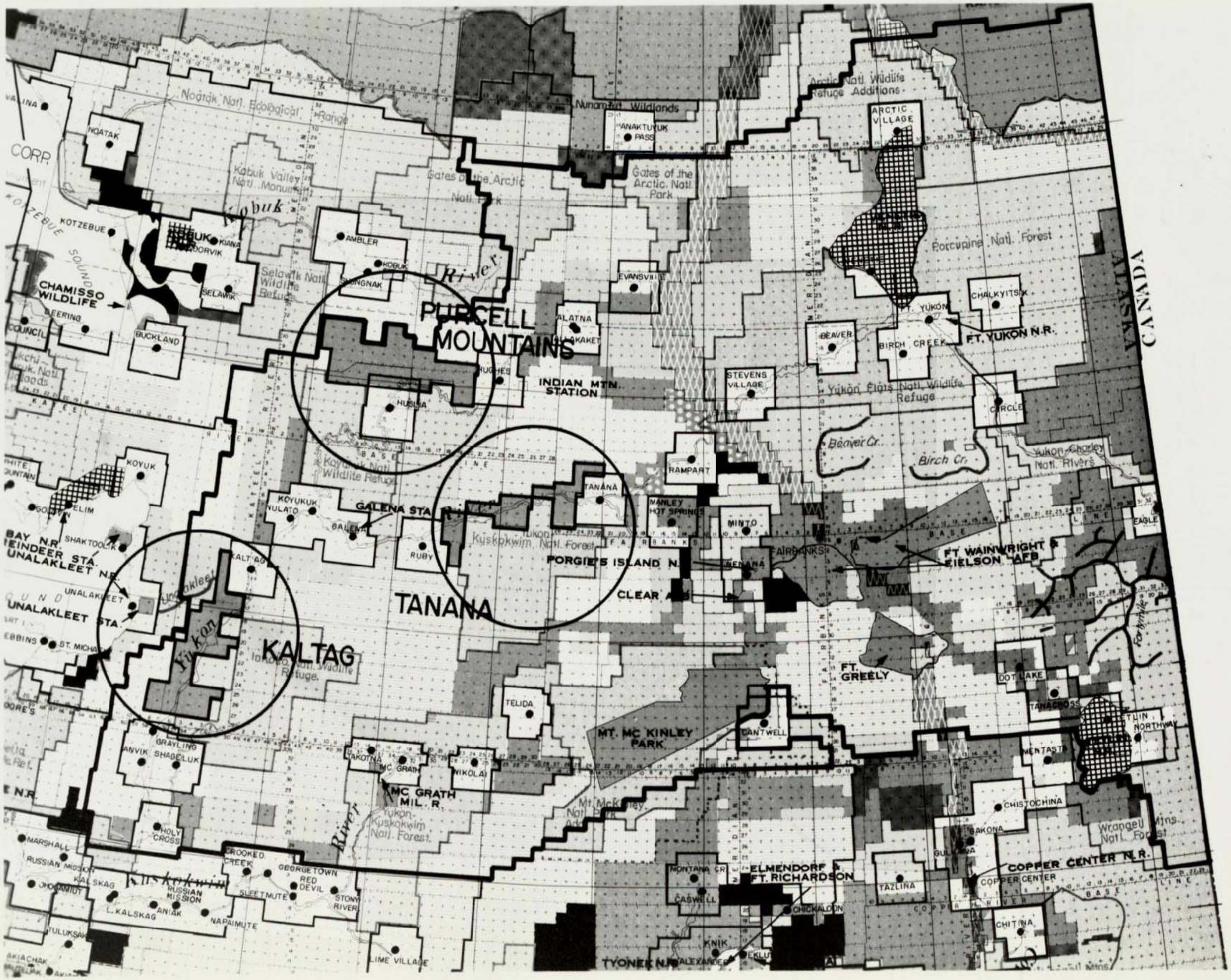

Figure 7   Regional Interest Areas

Three of the seven areas studied with the use of Landsat imagery are shown here. Resource maps for timber and mineral potential were used by Doyon to help identify lands for selection.

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The application of Landsat data to Doyon's resource-management problems brought interim benefits and a permanent benefit. The permanent benefit accrues from the final selection of lands which are yet to be adjudicated, owing to the complexity of competing claims of land ownership that predated ANCSA. Doyon recognized the possibility of conflicting claims on land of interest to them and over-selected by a wide margin the total acreage of their entitlement, based closely upon the results of the Landsat study of this grant.

However, Doyon also gained significant interim benefits in addition to the actual land selections. There are highly promising evidences of mineralization in three of the seven areas studied by Landsat imagery. A number of mineral exploration and development firms negotiated with Doyon for prospecting rights in Doyon's future land. After the completion of our study, Doyon concluded negotiations with a consortium of five firms: British Petroleum, Union Carbide, General Crude, Ethyl Corporation, and McIntyre Mines, which collectively operate under the name WGM, Inc. (Figure 8). The agreement implements a multi-million dollar exploration venture for hard-rock minerals in the more remote areas acquired by Doyon under the terms of ANCSA. The agreement also included provisions to guarantee the Doyon shareholders (Alaska Natives) an opportunity for training and employment in the exploration work. This provision by itself is a positive socio-economic benefit of major proportions to the rural inhabitants of interior Alaska.

Doyon exploring for minerals

By ERIN VAN BRONKHORST
Staff Writer

Doyon Ltd. has announced it is exploring for possible uranium and fissionable minerals in one of the land areas it has selected under the land claims act.

It's the third announcement this week about expansion of the Fairbanks-based Native regional corporation into minerals exploration and contracts with national firms. Doyon will be the largest private land holder in the world after it receives the land entitlement under the Alaska Native Claims Settlement Act of 1971. Doyon is the largest of the Native corporations formed under that act.

The uranium project involves an agreement with "several other exploration and development concerns," Doyon president John Sackett said. He declined to give their names, saying they would be revealed later by the other participants.

The target area is the Purcell Mountain-Zane Hills selection area, a block of approximately 500,000 acres located north of Huslia and west of Hughes in the northwestern part of the Alaska Interior.

"In keeping with our policy of active involvement whenever possible, Doyon will participate as an equally responsible party in a partnership arrangement," Sackett said.

Sackett said some radiometric work exploring the area was done from the air last year by the Energy Research and Development Administration, the successor to the federal Atomic Energy Commission. The Doyon staff had worked to find out the results before the land selection deadlines last December, Sackett said.

Recent reports have labeled the area as highly attractive for further uranium exploration, possibly the best in the state, Sackett said.

Earlier this week, Doyon announced a lease and partnership agreement with ASARCo, a New York minerals firm, involving asbestos mining. The deposit is located about 50 miles southwest of the Native village of Eagle and 60 miles west of the Cassiar Asbestos mine in the Canadian Yukon Territory, Sackett said in making that announcement.

A drilling program there was to begin this week, and a ten-member crew is already on site, Sackett said. The venture is undertaken through a newly created Doyon subsidiary called Tanana Asbestos Corp., Sackett said.

Last Friday, Doyon announced expansion of its minerals exploration program into the Yukon Territory. Sackett said it is creating "a multinational subsidiary capable of dealing in international enterprises." Doyon will enter partnerships with several other minerals development firms, Sackett said, and will work to determine similarities between the selection lands and those in Canada.

Doyon has been working for the past 10 months on an exploration of the hard rock minerals resources in its region. The venture has been done with a consortium of British Mines, with the consulting firm of WGM Inc., based in Anchorage and Toronto, acting as operator for the group. An exploratory oil well has been started on land in the Kandik Basin, under contract with Louisiana Land and Exploration Co.

Fairbanks Daily News-Miner June 24, 1976

Figure 8

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The significance of the University study is emphasized by the considerably strengthened stance adopted by Doyon during the negotiations with WGM, Inc. Based upon the mineralization evidences we provided, Doyon excluded from the negotiations those townships identified with probable mineralization. The impact of this decision was to concentrate the geoprospecting efforts in areas which had some promise, although with undetermined potential. The Purcell Mountain results illustrate how Doyon used information we provided advantageously in an area (Figure 9) which is larger than Delaware. The boundary of the withdrawal is marked in blue and the mineralized areas are delineated in orange. The townships marked in red were excluded by Doyon from the negotiations with WGM, Inc. The rationale for this decision was that our study provided sufficient information about the "red" townships for purposes of land selections, and that exploratory work should be directed on other lands with less obvious indications of possible mineralization.

Doyon also placed commercial timber as a resource of high priority for land-selection criteria. Landsat images of the seven regions were analyzed for commercial-timber potentials, and the results were used by Doyon in making their land selections. In view of sensitive political ramifications of their over-selection of land, Doyon has not publicly confirmed the details of their selection of lands. However, the public records of the Bureau of Land Management

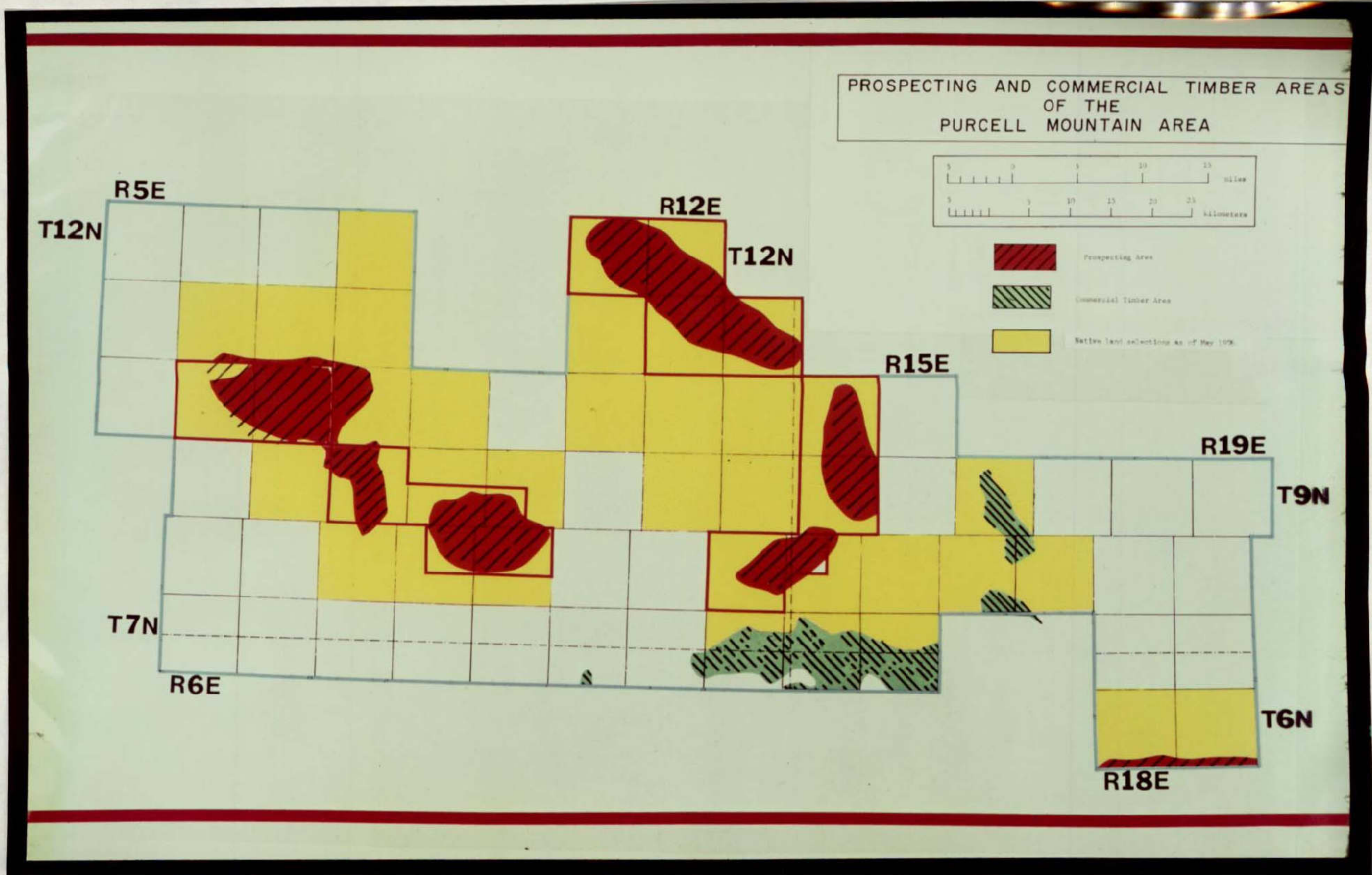

Figure 9 Purcell Mountain Area, Doyon Region
The map, derived from Landsat image interpretation, shows areas of timber and mineral potential. Areas of Native land selection, as of May 1976, are shaded yellow.

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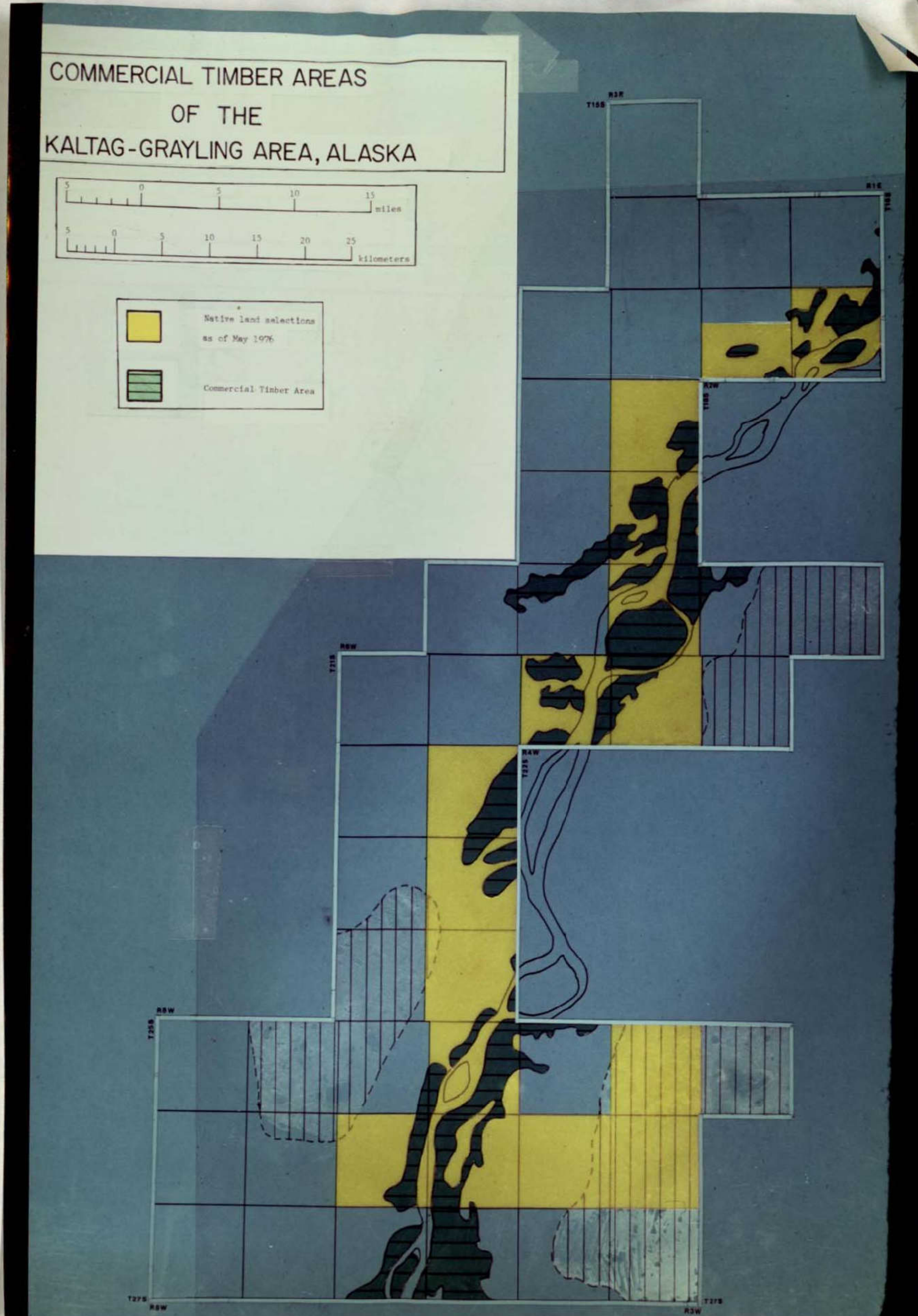

Figure 10 Kaltag Area, Doyon Region
Timber areas identified from Landsat imagery (green) and May 1976 land selection status (yellow).

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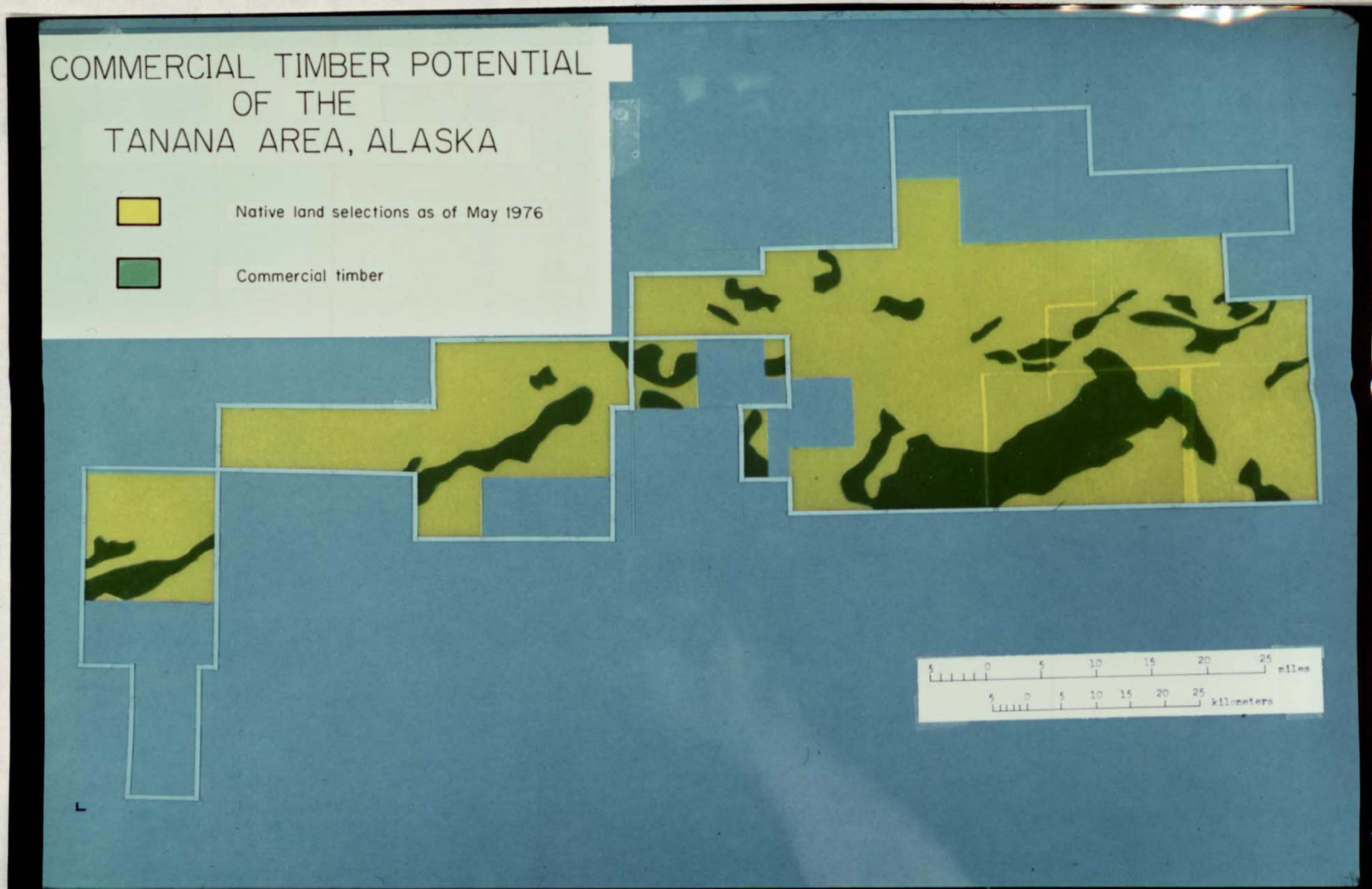

Figure 11 Tanana Area, Doyon Region
Timber areas identified from Landsat imagery (green) and May 1976 land selection status (yellow).

as of July, 1976, reflect the most significant Doyon decision. Lands selected in the Purcell, Kaltag Mountains, and Tanana areas are shown in Figures 9, 10, and 11. The overall lands available for selection are shown in blue, the mineral resources are in orange, the timber resources appear as green, and the land actually selected by Doyon is shown as yellow. In Figure 9 of the Purcell Mountains there is an obvious, close correlation between the results of the Landsat study and the action taken by Doyon. Similar results are evident in Figures 10 and 11 of the Kaltag and Tanana regions, respectively.

The significance of this project and the beneficial social and economic impacts of the results were recognized by an award from the American Revolution Bicentennial Administration (Figure 12). This project and the remote-sensing program at the Geophysical Institute were chosen as one of 200 community projects recognized by the "Horizons on Display" program as an example of problem-solving for communities which improve the quality of life. See Appendix C for details of the Horizons on Display award.

Applications of Thermal-Infrared Data

We attempted to address two applications of data from a thermal scanner in the Alaskan environment. One was to determine the correlation of heat-loss detection from the thermal data with insulation in buildings. There are many differences between the prevailing climatic and fuel-distribution

Figure 12 Horizons on Display
Al Belon and John Miller raise the Bicentennial flag over the University of Alaska as part of the Horizons on Display programs.

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patterns in Alaska compared to the midwest where this technique has proven feasible. The application of thermal scanning techniques to Alaska likely would require adaptation to appropriately address the Alaskan environment, and a pilot project to define the most suitable methods would have been desirable. Unfortunately, we were not able to obtain a thermal scanner to pursue this application.

The second application related to the operational integrity of the Alyeska oil pipeline. About half of the pipeline is being built on refrigerated piles above the ground owing to prevalent ice and permafrost under the ground. The hot pipeline must be separated from contact with the permafrost, and this separation is provided by the piles. To preserve the thermal integrity of the permafrost (which actually is in a rather fragile state of thermal stability) requires the extraordinary measure of chilling of the piles. It is imperative that Alyeska have an economical means of verifying that each of the approximately 300,000 piles is actively pumping heat out of the ground during the cold winter season. We have proposed that a thermal scanner can sense the difference in temperature of the steel pile and the ambient background of snow. Typically, this difference is expected to be on the order of two to five degrees Celsius, which is well within the range of thermal resolution of a scanner. Such an instrument flown over the pipeline at low altitude should produce a record of the pile's thermal signature, and this signature should identify any pile with submarginal performance.

We were, however, unsuccessful in our attempt to acquire a scanner for these feasibility tests. The lease of a commercial scanner was uneconomic within the existing level of funds, and our attempt to obtain a loan of a suitable scanner from NASA was unsuccessful. Yet, our work toward this concept was not without benefit. The object of the pipeline project would have been to test the usefulness of this concept so that Alyeska could take action to monitor the piles with their own or with leased facilities. There would have been no involvement in an on-going operational program of thermal monitoring of the pipeline with grant funds. The idea, although initially untested, had sufficient merit that Alyeska mounted a developmental program of their own to perfect the aerial thermal-surveillance technique. Figure 13 is a reproduction of a newspaper article which describes the operational use of Alyeska's thermal surveillance system and Figure 14 is an actual thermal image of a pipe section, obtained with the Alyeska equipment. In this instance there was an industrial benefit with only minimal consultative effort provided by this grant.

Alaska Department of Environmental Conservation

A map of cover types prepared along the Yakutat Forelands from computer-aided analysis of digital Landsat data also became a valuable tool for planning onshore activities in support of the offshore exploration. The Landsat results yielded clues to the region's natural processes because the

Pipeline will take own temp.

ANCHORAGE (AP)—The trans-Alaska oil pipeline will take its own temperature with a flying television thermometer system. The idea is to help frozen Alaska earth to keep its cool.

Consisting of a Bell 206 Jet Ranger helicopter containing video equipment with infra-red heat-detecting capability, it's designed to electronically monitor and display on a television screen the amount of heat produced by heat pipes installed for the pipeline's above-ground sections.

These 100,000 heat pipes, in pairs inside the steel vertical supports upholding the pipeline, are designed to prevent the frozen ground—called permafrost—at the bottom of the steel supports from melting. That could cause the ground holding up the pipeline to become mushy and unstable.

The pipes are especially important during the annual thaw when warm air conducts heat down through the steel supports. The pipes maintain the permafrost at freezing level using a heat transfer process.

A pipe consists of a sealed tube containing a fluid. When the air temperature is warmer than the permafrost it goes into action.

Heat from the soil enters the lower end of the tube causing the fluid to boil. The vapor travels to the upper end of the tube where it condenses on the cooler surface, releasing heat. The condensed vapor then drips down to the lower end of the tube and the cycle repeats itself. This process makes the heat pipes draw heat from the ground thus maintaining the permaforst.

The flying television infrared monitoring sytem assures that these heat pipes are functioning properly. Pipeline operators will survey the pipes annually by flying along the pipeline at about 100 feet and 30-40 mph, pointing the chopper's telephoto lens at the supports.

Fairbanks Daily News Miner - Wed Aug 11, 1976

Figure 13

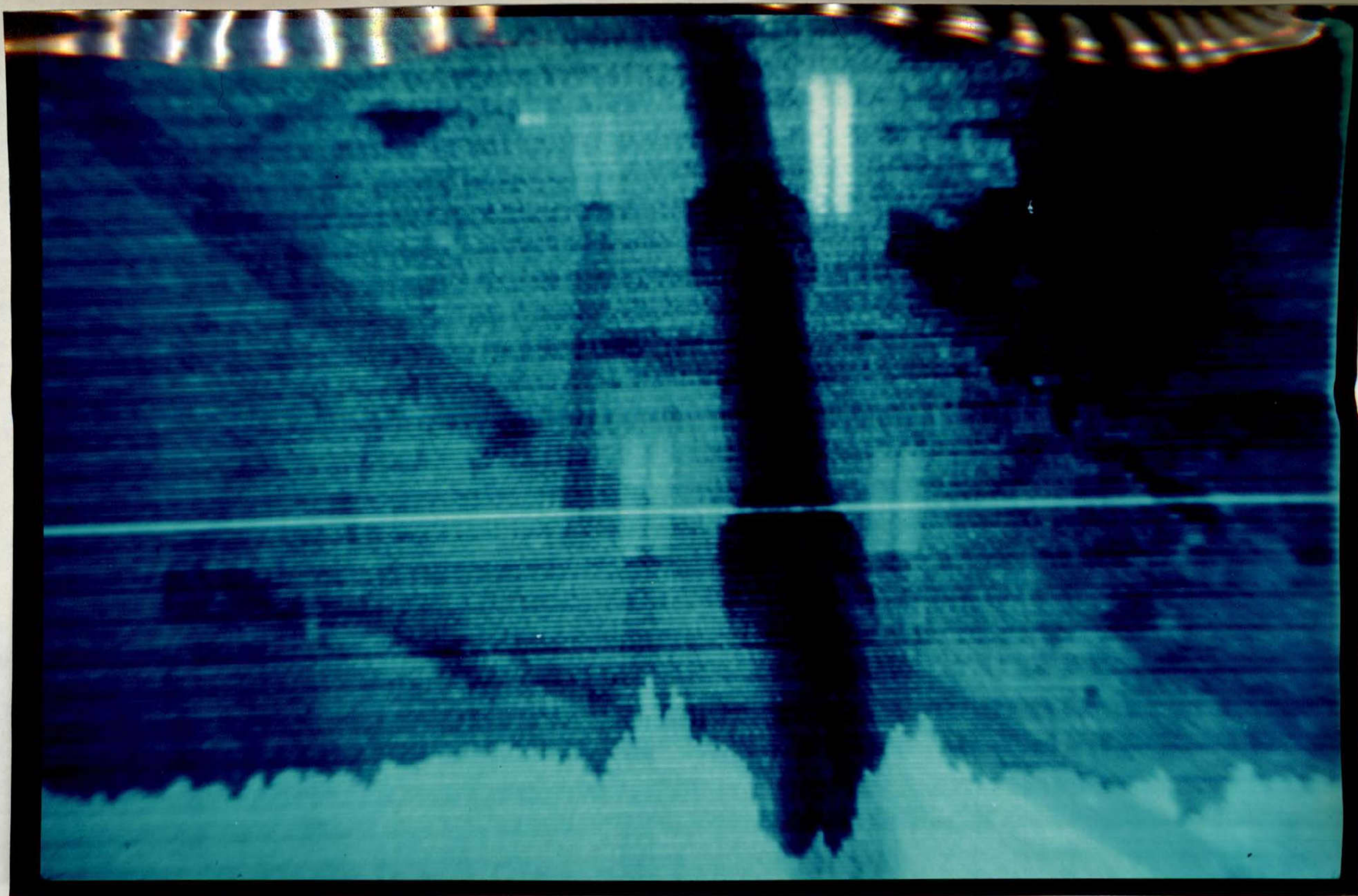

Figure 14 Thermal infrared image of the Trans-Alaskan Pipeline.
The pipeline is suspended on a cross member supported by two Vertical Support Members (VSM's). In permafrost, VSM's must be cooled to keep the ground frozen to insure the stability of the line. In the winter, heat is pumped out of the ground by heat pumps and radiated into the atmosphere. A thermal infrared scanner mounted in a helicopter will be used to monitor the heat pumps. This image shows one working radiator (white) on the right side of the pipeline. Three others have failed.

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vegetative types and stages of succession in this region are very closely related to the geologic and hydrologic factors which continue to shape the environment. Old beach lines and sediment trajectories evident in the satellite data confirmed the source and mechanism for the beach-building process that occurs along most of the forelands. Vegetational clues also give evidence of a history of catastrophic hydrologic events along the forelands. Apparently many hundreds of years ago the overflow from the glaciers feeding Russell Fiord drained across the forelands because numerous old channels are engraved in the data as mature spruce (climax species) against a background of mixed forest. A similar, but obviously more violent and probably more recent event occurred as an outburst flood from Harlequin Lake. Instead of old, meandering channels as from Russell Fiord, the outburst from Harlequin Lake carved striations indicative of a sudden, massive release of water. Maps of vegetative cover types prepared from digital analysis of Landsat data show two reasons to postulate the Harlequin Lake event occurred more recently than the overflow from Russell Fiord. The old flow channels from Harlequin Lake appear as seral stages of vegetation carved into the background of remnant stands of mature spruce; also, the straighter channels from Harlequin Lake cut across some of the overflow channels from Russell Fiord. Both of these features tend to date the Harlequin Lake event as more recent than the Russell Fiord event.

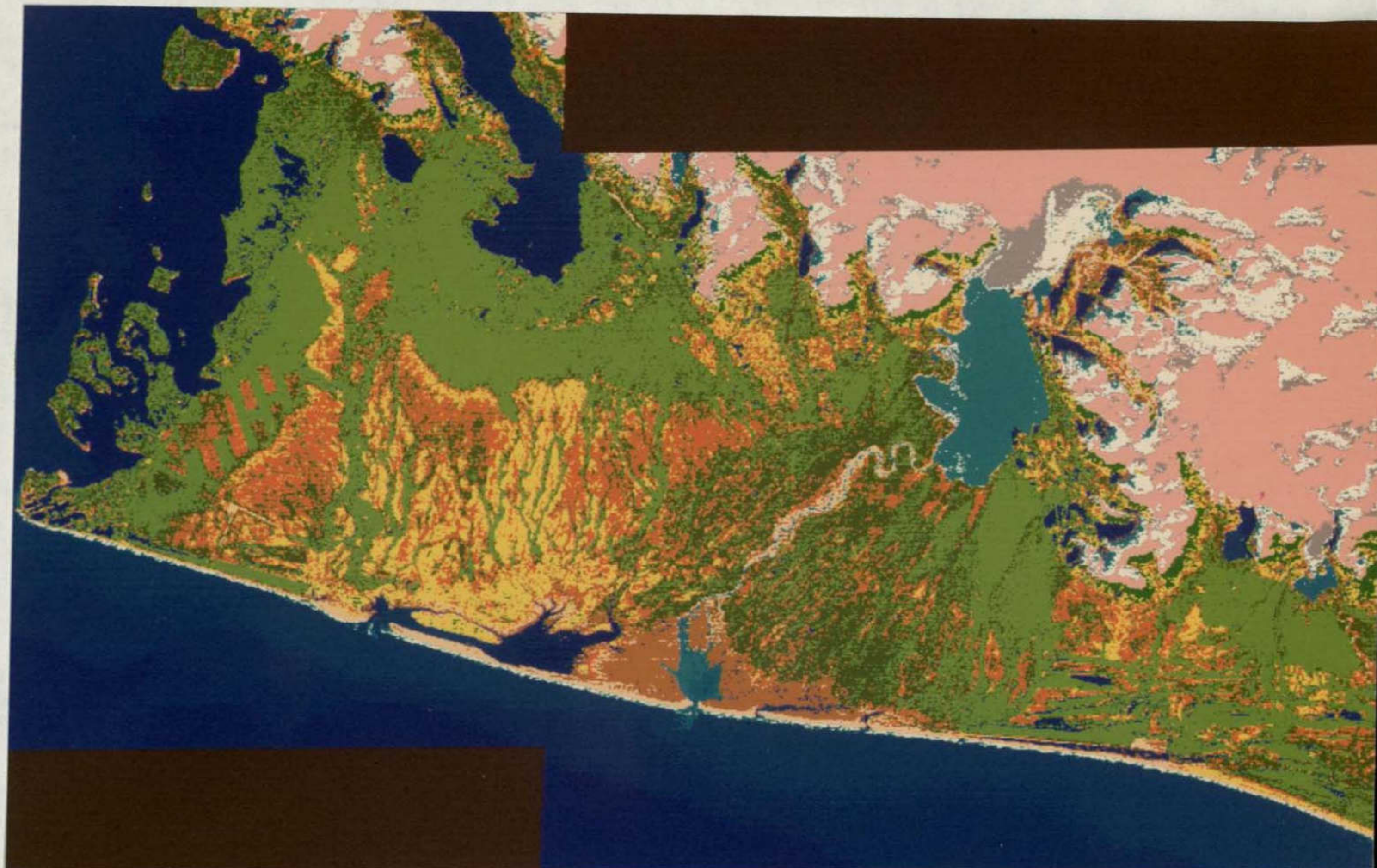

Figure 15   Color map of the Yakutat Forelands produced from computer analysis of Landsat imagery for the Dept. of Environmental Conservation.

Map Category	Color
Clear water	Dark bluish-purple
Slightly turbid water	Dark blue
Moderately turbid or shallow water	Medium blue
Turbid water	Medium cyan
Heavy silt-glacial flour	Cyan
Mud flats	Medium brown
Sand, gravel, pavement	Tan
Breakers (wave action) or melting ice	White
Wet snow and ice	Gray
Other snow categories	Pink
Mature spruce (closed canopy)	Olive (medium) green
Young spruce (open canopy)	Medium dark green
Spruce mixed with alder and aspen	Burnt orange
Wet meadow and lowland brush	Yellow
Upland brush	Bright green

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A final environmental tale was derived from the classification map. A stand of mature spruce apparently acts as a climatic buffer along the beach line of the western forelands. At Situk Bay the conifers have been stripped away, possibly by the events associated with Russell Fiord or Harlequin Lake or by more recent storms. Here the unbuffered winds are drifting the exposed sand landward causing the retreat of the vegetation in this region. A similar type of severe stress is also apparent along the southern beaches of Ocean Cape and Kahntaak Island, where the intermediate stages of succession are no longer conspicuous between the ocean and the inland stands of climax species.

This study helped to define the sensitive aspects of the environment of the forelands. It confirmed that much of the region is not suited for industrial development owing the potential hazards of life and property from outburst flooding, as well as likely adverse effects from erosion should the pattern of tall coastal forests be broken for development purposes. One consequence is that onshore facilities will be concentrated at Yakutat Harbor and at Dry Bay rather than the sensitive region of the forelands.

USDA/Soil Conservation Service-Range Inventory

The Alaska Native Claims Settlement Act will result in the transfer of some 40 million acres of Alaskan land from the federal government to the native people. Private, regional, and village corporations, formed to manage the land, are currently evaluating possibilities to develop their holdings. Reindeer herding, long practiced by the Natives, is one of the areas of interest to the Northwest Alaska Native Association (NANA) corporation. NANA requested assistance from the Soil Conservation Service (SCS) to plan development of the reindeer ranges.

Range management plans require plant and soil inventory information to plan grazing schedules, logistical arrangements, etc. Such data are lacking for the entire area, several million acres of reindeer range. Due to the short summer season, large acreages and lack of suitable photo coverage, SCS has conducted a joint project with the Geophysical Institute to attempt range inventory mapping from digitally processed Landsat data. A small pilot study was conducted during the summer of 1975 with promising results (See report in Appendix D). This has led to a self-supporting project to map 4 million acres of range land on the Seward Peninsula using Landsat digital data.

Chugach Native Corporation

The Joint Federal-State Land Use Planning Commission for Alaska called our attention to the opportunity to assist the Chugach Native Corporation in evaluating the resources of an area that recently was made available for their land selections under a revision of the provisions of the Alaska Native Claims Settlement Act. In particular, Chugach desired an evaluation of commercial-timber resources for some thirty townships located along the coastal margin of the Chugach Mountains east of Cordova on the Gulf of Alaska. Owing to persistent cloud cover an aerial reconnaisance proved unsuccessful, and time constraints made the likelihood of rescheduled reconnaissance efforts appear dim.

On an urgent basis, we obtained Landsat imagery of that region reconstituted in false color at a scale of 1:250,000. Using techniques similar to those applied on behalf of Doyon, Ltd. we evaluated the potential timer-resources for each township on a rating scale from 0 to 10. This information was a primary component in subsequent land selections by Chugach Native Corporation.

BP-Alaska Inc.

A digital classification map previously prepared on behalf of the Alaska Department of Environmental Conservation was used to assist BP-Alaska in locating a near-shore drilling platform near the Sagavanirktok River delta in the Beaufort Sea. Geological considerations primarily determine the best location for drilling, but cost and environmental factors in this instance favored a site on one of the many existing islands in the delta. BP-Alaska attempted to locate the nearest island by drilling through sea ice and shallow water during the past winter, but without success. The island nor its neighbors were found at the positions shown by existing maps. The dynamic nature of the shoaling and erosional processes had caused the migration of some of the islands to unknown positions (See Figure 16). With the information provided to BP-Alaska by the Landsat thematic map, the drilling schedule was revised from a location on a natural island to an artificial gravel island to be constructed at the geologically preferred location. Such a commitment entails a new application for a drilling permit from the Corps of Engineers, plus justification for the increased environmental impact of an artificial island. Without the aid of Landsat data, the company probably would have had to invest much more time and money before commiting itself to the construction of the artificial island.

North Slope Borough

Available maps of the Alaskan north slope are often inaccurate and deficient in information relating to physiographic and thematic distribution of landforms. The recently organized North Slope Borough was confronted with this impediment to the environmental survey and management of its vast territory. The Borough Planner asked our help in the expectation that satellite imagery could help fill the gaps of available knowledge. As a result of ensuing discussions, we constructed a Landsat mosaic in black-and-white of the entire Alaskan north slope at a scale of 1:250,000. Twenty-two selected summer images were used in the construction of the mosaic (See Figure 17).

Figure 16 The composite of three data sources indicates the variable nature of island location in the Sagavanirktok River delta as a function of time and data source. This information helped BP-Alaska decide to drill from an artificial island.

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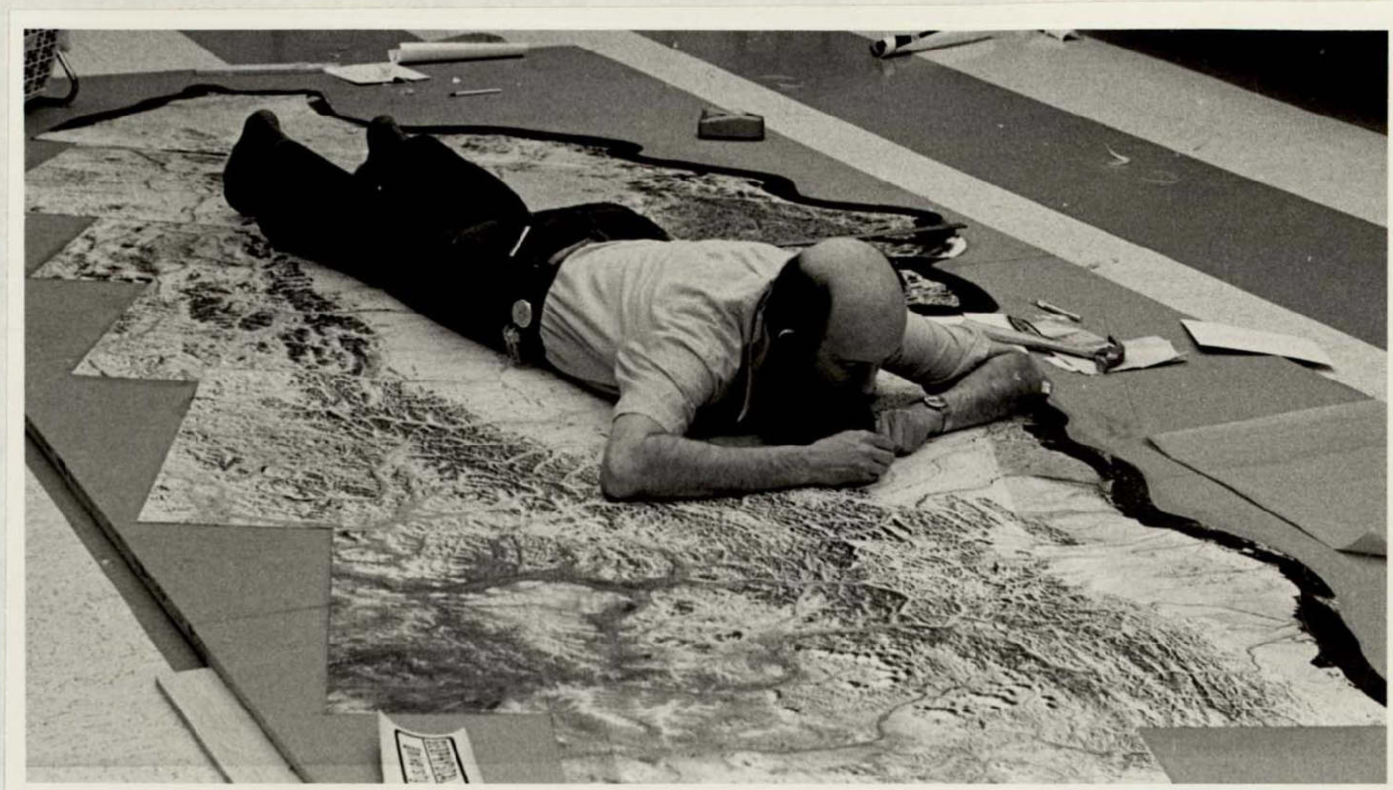
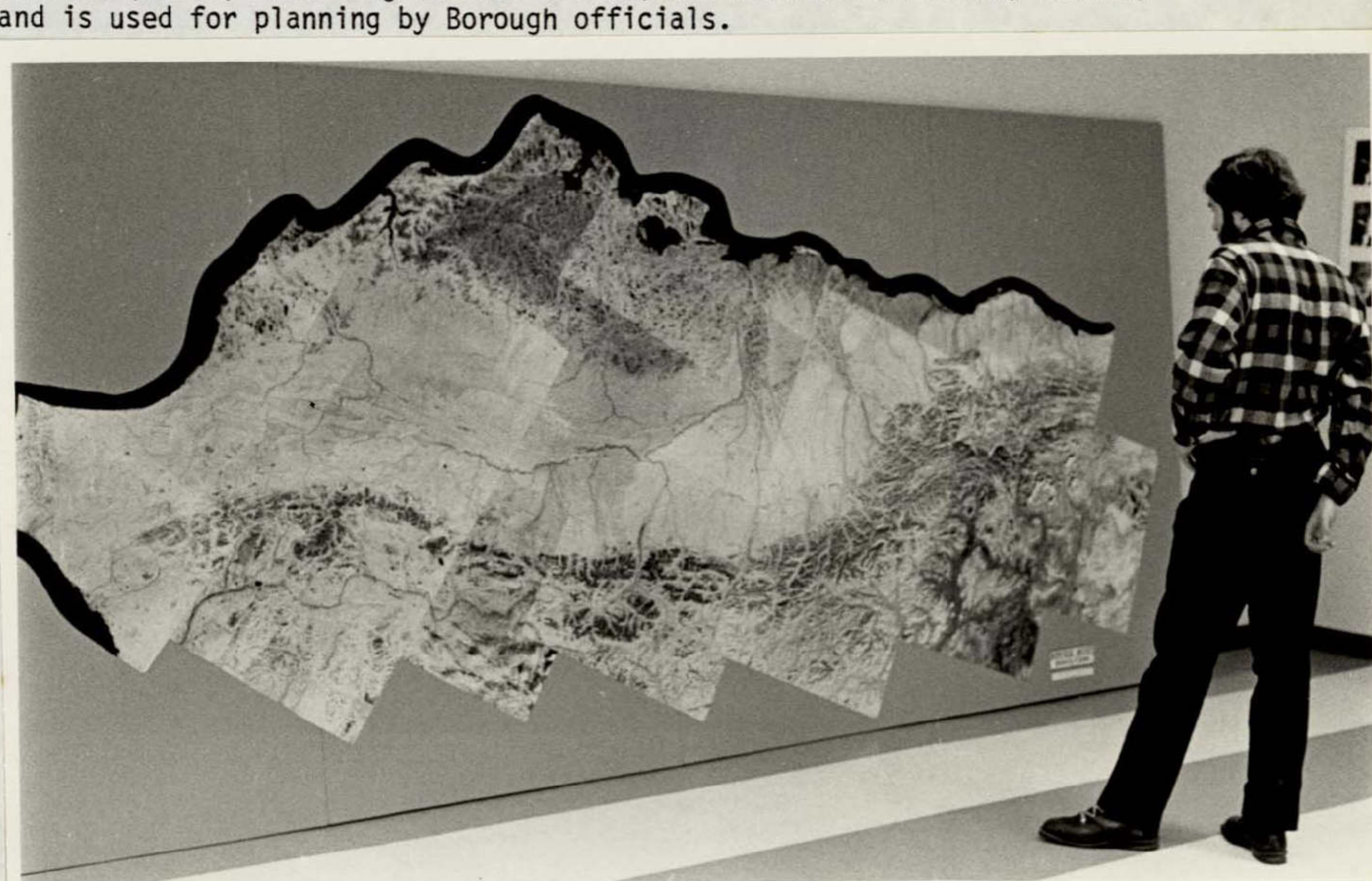


Figure 17   Alaska North Slope Mosaic
Photographer Mal Lockwood (above) puts finishing touches on the 1:250,000 scale Landsat mosaic produced for the North Slope Borough. The completed mosaic, (below) measuring 16 feet across, now resides in Barrow, Alaska, and is used for planning by Borough officials.



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Although Landsat images are nearly orthographic, owing to the great altitude of the satellite and the narrow field-of-view of its sensors, there is an appreciable distortion of scale throughout the 24° of longitude encompassed by the north slope of Alaska. The task of compensating for this cumulative distortion, controling the scale factors, and matching print densities proved very challenging.

The mosaic measures 6 ft. by 16 ft. and is installed in the assembly room of the North Slope Borough headquarters at Barrow, Alaska. Reports from Borough officials indicate that the Eskimo constituents relate much more readily to the familiar landforms depicted on the Landsat mosaic than they do to stylized topographic maps with confusing lines and symbols which are foreign to the Eskimo culture.

USDA/Soil Conservation Service-Flooding

This cooperative project mapped the extent of flood hazards from Landsat imagery in an area near Delta Junction, 160 km southeast of Fairbanks. Various types of enhanced images were interpreted to delineate the flood-related features associated with the vegetation and terrain (Fig. 18).. A major discovery was the ability to document aufeis-related flooding during the spring of 1974. Owing to severe stream-icing (aufeis), ice dams formed during the winter and altered the course of Jarvis Creek into a much smaller, adjacent waterway 15 km long. Much of the affected area is under development for agriculture. The Soil Conservation Service

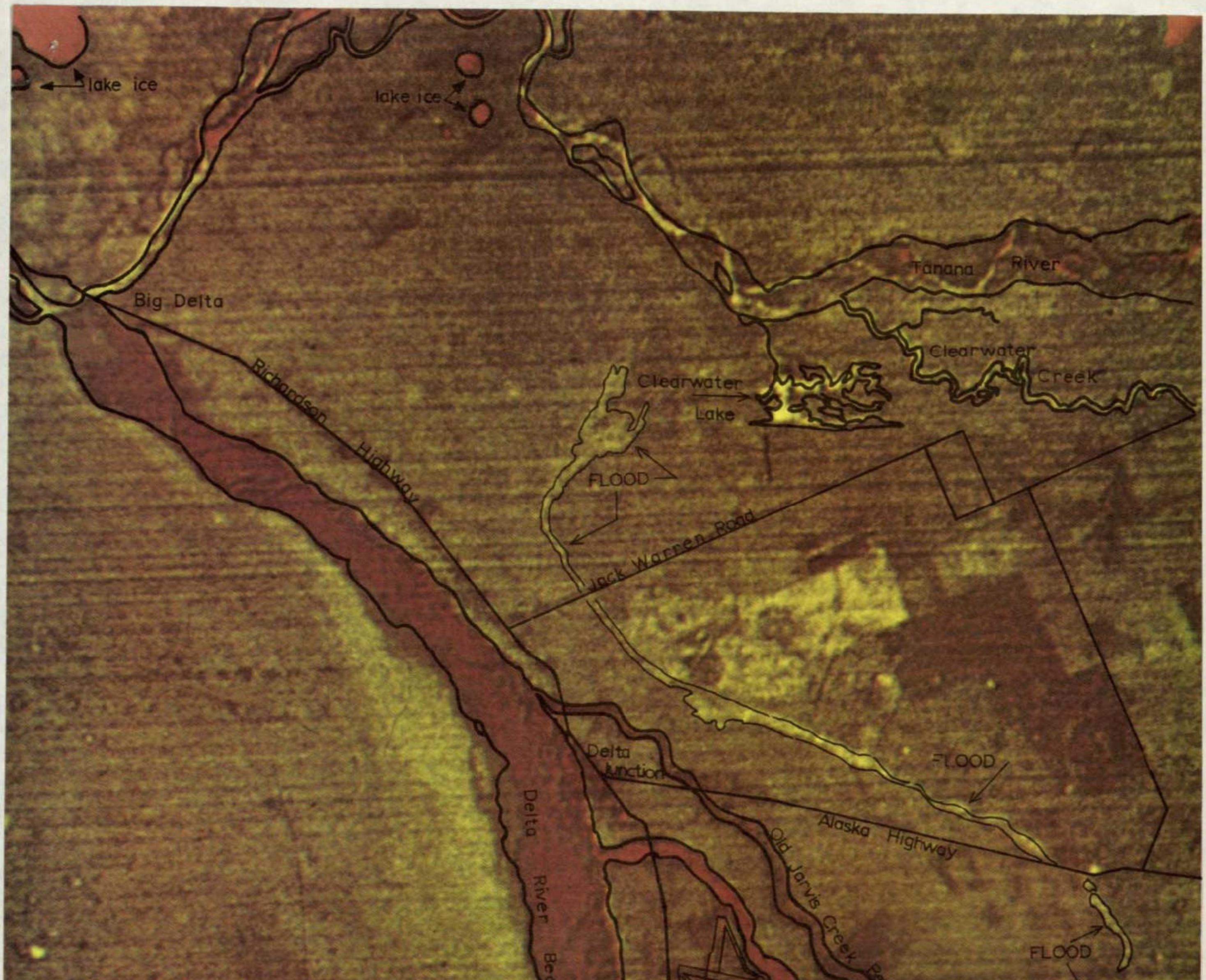

Figure 18 Aufeis Flooding
This Landsat false color composite was used by the Soil Conservation Service to identify flooding caused by stream icing near Delta Junction, Alaska.

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is using the results of this project (see report in Appendix D) to study remedial measures, although there is no commitment by any agency to establish flood-control measures.

Corps of Engineers

Photo interpretation of a series of Landsat scenes of the Swan Lake region in Southeastern Alaska near Ketchikan provided critical information to the Corps of Engineers for siting of a transmission line and definition of dam-design specifications for a proposed hydroelectric project. The Landsat images enabled agency engineers to select the route of the transmission line to avoid stands of tall, dense forests without the expense of an aerial mapping program. Building a transmission line through densely forested areas is costly and environmentally unsound.

Landsat images were also used to map more accurately subtle lineaments and faults in the region than is possible from aerial photos. The geologic and infered seismic interpretation of the Landsat images yielded a revised assessment of the seismicity factors that influence the design of the dam. Prior to the use of Landsat data, the design parameters relating to seismic risk were selected on a somewhat arbitrary fashion to allow for a generous safety factor. After the analysis and interpretation performed by Corps engineers on Landsat images, these design criteria were substantially strengthened owing to evidence of increased seismic risk that was documented by the Landsat images.

National Oceanic and Atmospheric Administration

One million acres of continental shelf oil leases were deleted by the Department of Interior from the Northern Gulf of Alaska lease sale conducted April 13, 1976 (Figure 19). This decision had a great impact upon oil development and was based upon the circulation patterns that are evident on LANDSAT images. The circulation patterns in the north Gulf of Alaska adjacent to the Copper River delta were analyzed by numerical-modeling techniques and a few direct current observations by the NOAA Pacific Marine Environmental Laboratories (PMEL), and by analysis of satellite imagery. The satellite data formed the hard experimental evidence that substantiated the theoretical prediction that a system of complex gyres are persistent summer phenomena. The implications of this feature were so pronounced that NOAA recommended to BLM and the Department of the Interior that sixteen tracts totaling one million acres not be leased for petroleum exploration and production owing to the risk of environmental damage on shore from petroleum contaminants from offshore exploration activities. Further corroboration of the reality of a gyre in this region of the northern Gulf of Alaska came from late summer experiments. A buoy was air dropped into the ocean and its location tracked for a period of weeks. As expected, it became trapped in a closed pattern that confirms the Landsat evidence (Figure 20).

While conventional sea truth and mathematical modeling techniques were employed, the Landsat imagery supported a

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Figure 19 Offshore Continental Shelf lease tracts sold April 13, 1976. Days before the lease sale was conducted, the western 16 tracts (arrow) were deleted on the basis of numerical modeling studies and surface circulation patterns interpreted from Landsat imagery which indicated the presence of a gyre that would potentially trap any contaminants that might be released due to offshore activities.

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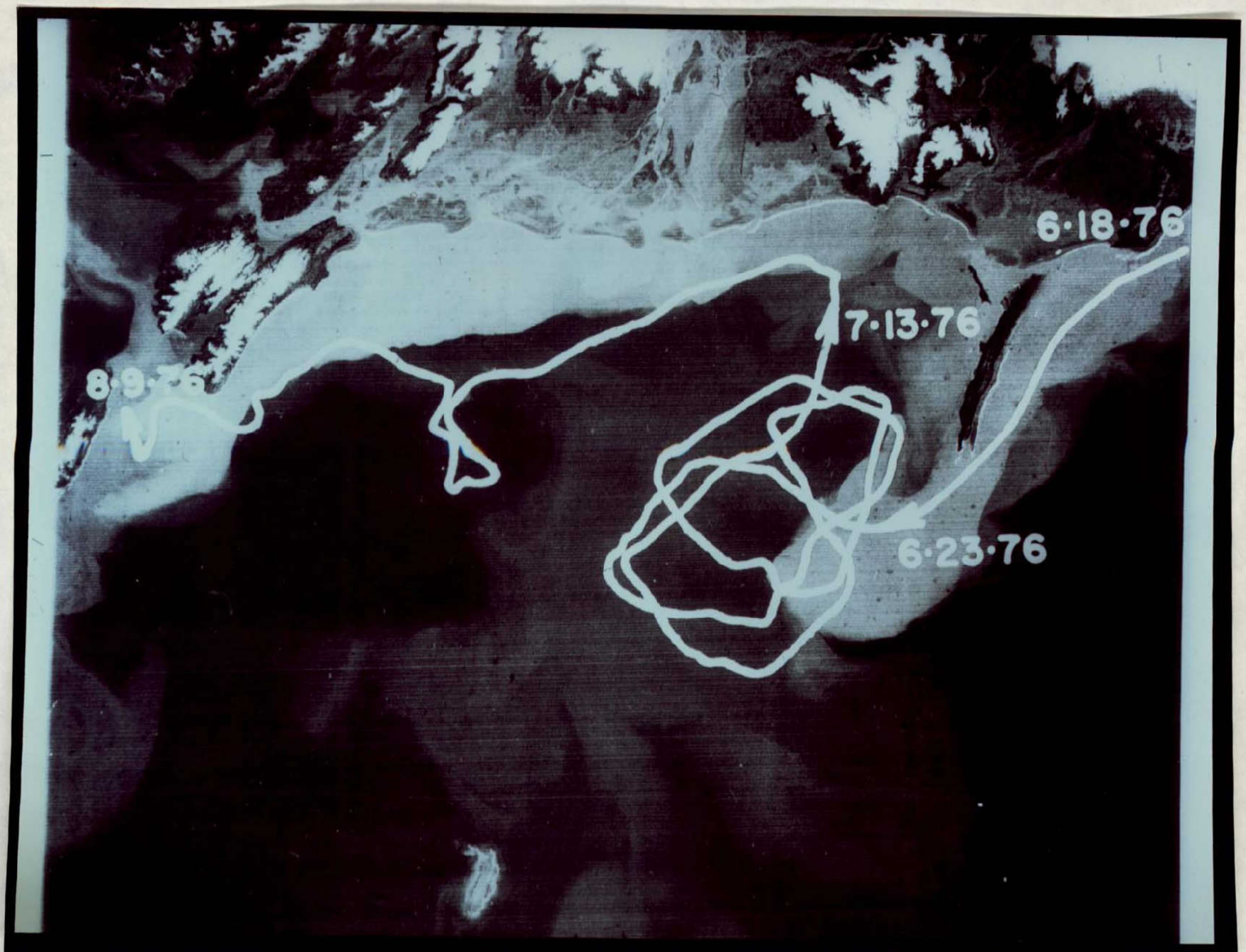

Figure 20
Surface circulation patterns interpreted from this Landsat scene provided supportive evidence of a suspected gyre in the Gulf of Alaska which led to withdrawal of 16 lease tracts from the April 13, 1976 OCS lease sale. Following the sale, a data buoy was tracted as it drifted through the area (white line) which confirmed the gyre.

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number of key conclusions concerning the circulation in the region. The first point is that the positions of the gyres varies from time to time and may shift from a double gyre to a single gyre system, but in all cases the nearshore circulation suggests a counter-clockwise gyre. The second point is that although non-summer imagery is limited, the presence of the gyres may be a summer season phenomenon. This conclusion is consistent with the model results that predict that the gyre system is partially dependent upon the freshwater run off from the Copper River.

The importance of the Landsat analysis lies in the fact that the prediction model alone lacked sufficient weight to warrant a radical action such as the deletion of all tracts west of Kayak Island from the lease sale. However, once the prediction of persistent gyres was borne out by the hard physical evidence of Landsat images, the critical recommendation for not permitting oil exploration rapidly progressed from NOAA officials, who were first convinced of the merits of the warning, through BLM review and to the Secretary of the Interior, who took action to delete this area just a few days prior to the lease sale (See newspaper reports, Figures 21 a, b and c).

Alaska State Troopers and U.S. Secret Service

The agencies charged with security surveillance for the visit of President Ford in November 1975 lacked reliable maps of the roads and trails in the hills overlooking Eielson AFB and Alyeska Pump Station #8, which were sites on the

Fairbanks Daily News-Miner - April 6, 1976

Judge denies delay in Gulf lease sale

By BETTY MILLS
News-Miner Bureau

WASHINGTON—U.S. District Court Judge Joseph C. Waddy Tuesday denied the state of Alaska's bid to delay the oil and gas lease sale in the Northern Gulf of Alaska, scheduled for one week from today.

Waddy denied the state's request for a preliminary injunction to delay the sale until the case could be argued on its merits at a trial, saying the nation's need for energy outweighs the need to protect the environment.

Assistant Attorney General Sanford Salgalkin indicated he will file an immediate appeal.

The decision came after a three-hour hearing and a long dissertation by the Judge of the steps taken by the Interior Department to comply with the National Environmental Policy Act in the Gulf of Alaska sale.

In a related development, the department announced Tuesday the deletion of 18 tracts west of Kayak Island which have been tagged by the National Oceanic and Atmospheric Administration as risky areas from an environmental standpoint.

"This court finds that there is little likelihood of success by the plaintiffs on the merits (of blocking the sale until further environmental analysis is conducted)," Judge Waddy said.

"The court finds that the national interest outweighs the interest in the environment."

Judge Waddy said if he had been in the Interior Secretary's position of deciding whether or not to hold a lease sale in the Northern Gulf of Alaska, he "might very well have come to a different conclusion.

"But this court cannot substitute its judgment for that of the secretary if he has in fact weighed the possibility of balancing a delay as against that of the national interest," the Judge said.

Unless blocked by the state's appeal, the lease sale will go forward in one week in Anchorage, as planned by the Interior Department but with the 16 tracts west of Kayak Island removed.

The acreage of the 16 tracts was not immediately known, but it should reduce the 1.1 million acre sale area only slightly, sources said.

William Cohen, arguing the case for the government, cited legal precedents in other suits which have failed to halt outer continental shelf drilling in the Southeast and in California.

Sagalkin and Assistant Attorney General John Tillinghast argued that once the lease sale is held, the impacts upon Alaska will be great and immediate.

Judge Waddy interrupted both the arguments of the state attorneys and of Cohen repeatedly with questions, indicating a knowledge of the case and the voluminous briefs and exhibits filed in the proceeding.

Sagalkin argued, "We want the court to require full compliance with NEPA in this sale. What the court does in the Gulf of Alaska will have a bearing on all the other sales in the state."

The Interior Department has scheduled eight more OCS sales in Alaska in the next three years.

Salgalkin said the state is concerned mainly with the onshore impacts to the small fishing village of Yakutat and the somewhat larger cities of Cordova and Seward.

"The human environment is what the plaintiffs are interested in protecting," he said.

An attorney representing Yakutat, a party to the suit, argued that the case "may well be the undoing of the city of Yakutat."

Cohen, arguing for the Interior Department and Secretary Thomas S. Kleppe, the principal defendant, said, "The court is being asked to balance the competing public interests—energy versus environment.

"The state of Alaska demonstrates a focus on regional needs...in every OCS case, the plaintiffs argue about the uniqueness of the area," Cohen said.

Judge Waddy interrupted: "Those two competing needs, energy and the environment, that's really the heart of this case."

Edward Bruce, an attorney representing the Western Oil and Gas Association and eleven oil companies that are members, said the industry has invested over $100 million in preparing for the Gulf sale.

Bruce was allowed to argue his case as an intervenor in the proceeding.

Judge Waddy, in issuing his decision, said, "In considering the issue of delay, the first question that comes to the mind of the court, is whether delay would change that hostile environment (of the Gulf of Alaska) or minimize the dangers

Figure 21a

Figure 21 (a, b & c)   OCS lease tract deletion
These three news stories appeared in the Fairbanks Daily News Miner outlining the events leading to the Department of Interior's withdrawal of 16 tracts from the northern Gulf of Alaska lease sale.

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Fairbanks Daily News-Miner, April 7, 1976

OCS ruling impacts entire federal plan

By BETTY MILLS
News-Miner Bureau

WASHINGTON—This week's federal court decision denying the State of Alaska's request for a delay in oil and gas development of the Northern Gulf of Alaska injects added immediacy in the state's case. Gov. Jay Hammond says the state will seek another injunction this week in the hope of avoiding the oil and gas lease sale scheduled for April 13.

U. S. District Court Judge Joseph C. Waddy's decision Tuesday denied a request for a preliminary injunction to delay the sale on the ground that the nation's energy needs outweigh the need to protect the environment.

Meanwhile, the department is moving ahead with its plans to conduct eight more lease sales in Alaska by December, 1978

The 1.7 million acres of tracts in the southeastern Bering Sea will be studied for the department's environmental impact statement.

The public information officers argued that release of the two announcements on the same day would inspire a wave of news stories and editorials contending the Interior Department moved ahead ignoring great opposition in the state of Alaska.

The public information officers won a delay of a few days in the release of the Bering Sea tract announcement.

The Bering Sea sale is scheduled for early 1977, but sources believe it will not take place that soon. Many say the type of objections that apply to the Northern Gulf sale apply equally to the southeastern Bering Sea area—a sizeable fishery, a major breeding and feeding ground for many birds, fish and mammals in the St. George Basin, and small Alaska villages are nearby. All would be impacted.

Meanwhile, some disgruntled government officials, upset at Interior Secretary Thomas Kleppe's decison to go ahead with the Gulf sale, are aiding the state in its suit, sources said.

John W. Townsend, associate administrator of the National Oceanic and Atmospheric Administration, in a recent letter to George L. Turcott, associate

News analysis

director of the Bureau of Land Management, said leasing of certain of the Gulf tracts could cause considerable ecological harm.

"The evidence we now have in hand would contradict rather strongly the Secretary's statement in his February 18 press release (announcing his decision to go ahead with the Gulf sale) that 'those sixteen (tracts to be leased west of Kayak Island are) environmentally less risky than other tracts in that area because of prevailing wind and current patterns.' Based on information accumulated to date, we would have to conclude that in fact these sites may well pose considerable risk to biological populations in the immediate lease area as well as to populations in the region of the Copper River Delta and entrances to Prince William Sound."

Such a statement by a high-ranking government official can only fuel Alaska's claim that the sale should not be held until more environmental information is available.

The Interior Department is in the process of revamping its Outer Continental Shelf (OCS) leasing schedule, which has been shot to pieces by delays since it was issued in June, 1975

The news release announcing the Bering Sea tract selection reads: "The Alaskan sales in this schedule are currently under review in an effort to find ways to better harmonize the needs of Alaska and the environmental needs of the nation. The state of Alaska has been asked to participate in this review."

The complicated OCS process works as follows:

—the Interior Department issues a "call for nominations" from industry of promising tracts in a specific offshore area;

—the department publishes the tract list, citing the areas to be studied in a draft environmental impact statement;

—after publication of the draft statement, public hearings are held, with comments incorporated into a final statement;

—thirty days after the final statement is submitted to the President's Council on Environmental Quality, the secretary of Interior determines if the sale should be held, and the term of the sale;

—operating orders and stipulations are issued for the lease area, and the sale is held.

Under the leasing schedule, six OCS sales are to be held in the U.S. in 1976.

The 1976 schedule and the status of the sales are as follows:

—Gulf of Mexico, held on Feb. 18;

—Northern Gulf of Alaska, scheduled for April 13, after being slated for December, 1975, originally;

—Mid-Atlantic Baltimore Canyon trough, scheduled for May, but cannot be held until July or later, due to delays in the public hearings and impact statement process;

—North-Atlantic Georges Bank, scheduled for August, but already running three months late in the tract selection process;

—Gulf of Mexico, scheduled for October, but running more than two months late;

—South Atlantic-Southeast Georgia Embayment, scheduled for November, but tract selection is three months late.

It does not appear that the Interior Department will come anywhere near its goal of six sales in 1976.

The states of Massachusetts and New Jersey are opposed to the sales off their coastal areas, just as Alaska is.

The White House Office of Management and Budget has projected revenues to the federal government of $6 million in fiscal year 1977, from OCS sales.

"There is just no way we're going to make it," one government official said recently.

Still on tap for Alaska are the Western Gulf of Alaska sale, which had been scheduled for December, 1976, but is off target since tract selections were due two months ago but have not been completed yet. Also, the lower Cook Inlet sale is scheduled for late 1976, but has been delayed.

Also in the future for Alaska are the following sales:

—the Beaufort Sea in October, 1977;

—the Outer Bristol Basin in December, 1977;

—the Bering Sea-Norton Basin in August, 1978,

—the Gulf of Alaska Aleutian Shelf sale in October, 1978;

—the Chukchi Sea sale in December, 1978..

The outcome of the state's suit to block the Northern Gulf of Alaska sale will have grave repercussions for these future Alaskan sales, as well as the Interior Department's entire offshore drilling program.

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Figure 21b

FAIRBANKS DAILY NEWS-MINER THURS. APRIL 8, 1976.

Interior Department deletes tracts from lease sale area

Oil companies interested in offshore drilling in the Gulf of Alaska lost one of four potential oil structures Tuesday when the Department of Interior removed the last of the oil lease tracts in the western portion of the sale area.

The Northern Gulf of Alaska lease sale, scheduled for Tuesday in Anchorage, was cut from 2.1 million acres to 1.1 million acres late last year when environmental review of the area recommended against oil development in much of the western portion of the 150-mile-long area.

Only 16 lease tracts were left in the area west of Kayak Island and about 60 miles directly south of Cordova, and these last 16 were in an area where early seismic research by the oil industry is said to have located a potential oil-bearing formation.

The 16 tracts were withdrawn Tuesday on recommendation of the National Oceanographic and Atmospheric Administration, which said the arguments that eliminated the neighboring tracts applied equally to the remainder.

The final area to be withdrawn clustered around one of the four possible oil-bearing formations.

With the action, the federal government's lease sale Tuesday will be limited to the 167 tracts east of Kayak Island. The State of Alaska, however, has its eye on 24 of those tracts as well.

Here the state contends that Interior's boundary line marking the border of the state's three-mile coastal limit and the beginning of the federal Outer Continental Shelf (OCS) lease sale area extends farther south than indicated in Interior's maps.

Interior Department experts are meeting with state officials this week on the state's charge, and the state threatens to sue the federal government to stop the lease sale if the question is not resolved by the end of the week.

The state's challenge is doubly important because the 24 tracts in question are in the northeastern portion of the lease sale area where the largest potential oil pool is believed to be located. That structure butts against the state's three-mile boundary on Interior's map, and the state could gain valuable territory even if the lease sale does go on.

The state lost an earlier attempt to block the lease sale in court Tuesday when a suit challenging Interior's environmental impact statement failed to get a preliminary injunction to stop the action.

Wednesday, minutes before the clerk's office closed, Assistant Atty. Gen. Fred Boness filed a suit in U.S. District Court in Anchorage seeking a temporary restraining order on disposal of the 24 tracts which may be under state jurisdiction.

Boness said Wednesday, "I believe the state has a stong case," explaining that Umbrella Reef was not taken into account by the Department of Interior, nor were other geological formations in the Icy Cape and Cape Yakatag areas.

Boness stressed the suit filed Wednesday sought to enjoin the sale only as it concerned disputed tracts in the eastern portion of the lease sale area.

Figure 21c

President's itinerary. These roads and trails had been developed on the military reservation and are not shown on any available maps. When the Secret Service began to plan for security measures they were frustrated by a lack of detailed knowledge of the terrain for which they had to provide protection to the President's party. At their request we provided within 24 hours color prints from U-2 coverage of the area that were prepared in our own laboratory.

Conferences and Meetings Attended

We have maintained membership and active participation in the Alaska Rural Development Council, an organization consisting of delegates from federal and state agencies and other organizations with statewide developmental concerns. The activities of the Council emphasize the long-range analysis and development of resources, particularly agriculture, land-use planning and development, and the development of rural governmental and industrial entities. See Appendix E for details of the structure, goals, and membership of the Council.

The summer meeting of the Council was held in Bethel July 9-10, 1975, and was devoted to difficulties in interpretation and implementation of the Alaska Native Claims Settlement Act, the lack of grazing access by reindeer herds to public lands administered by the Bureau of Land Management and the U. S. Fish and Wildlife Service, and the resource survey of southwestern Alaska produced from Landsat data by Calista Corporation. Mr. Paul A. Goodwin, alternate delegate from the Geophysical Institute attended the July meeting in Bethel.

The fall meeting of the Council was located at Palmer, October 8-9, 1975, and the Geophysical Institute was represented by Dr. William J. Stringer, who presented a review of the use of Landsat data. A major theme of the meeting was the need to identify and protect agricultural lands from encroachment by residential developers.

The spring meeting of the Council was attended by Mr. J. M. Miller, the permanent Institute representative on the Council. This meeting was conducted in Kodiak January 13-14, 1976, and was devoted largely to the expected impact on the communities of Kodiak Island of petroleum-related development in lower Cook Inlet as well as the Gulf of Alaska. Coastal Zone Management problems relating to land use planning were of prime interest. Dr. Selkregg of the University's Arctic Environmental Information and Data Center presented the details of the regional profile (atlas) of the Kodiak region. She stressed the importance of the data base (in part from use of Landsat images), and explained the need to continually up-date the resource information in the atlas.

Mr. Miller also attended the spring meeting of the Council April 13-14, 1976, in Juneau. Discussions were heavily weighted upon the need for an Alaskan Forest Practices Act to better manage forest resources, and better regulation of agricultural resources.

Other meetings and conferences relating to remote sensing were attended throughout the year. Mr. Miller presented a paper titled, "A Look at Alaskan Resources with Landsat Data" at the 10th International Symposium on Remote Sensing of the Environment, and sponsored by the Environmental Research Institute of Michigan, October 6-10, 1975, at Ann Arbor, Michigan. Dr. Stringer and Mr. T. H. George attended the Alaska Surveying and Mapping Convention, sponsored by the American Society of Photogrammetry and the American Congress of Land Surveyors, in Anchorage in January. Mr. Miller also attended a briefing and award ceremony in Washington, DC January 29-30, 1976. This was the official designation of the "Horizons on Display" award by the Department of Housing and Urban Development and the American Revolution Bicentennial Administration for our work in using satellite technology to aid in land selections by Alaskan Natives.

CONCLUSIONS AND RECOMMENDATIONS

We have emphasized the development of applications of remote-sensing data to a wide range of issues in Alaska which relate to the shortage of raw materials, energy exploration and development, and social problems such as the settlement of the land claims of Alaskan Natives. We have introduced a growing cross-section of public and private agencies in Alaska to the use of remote-sensing data, both satellite and aircraft. We have engaged in cooperative projects which involved the performance of operational activities, and we have provided assistance upon request for data processing, enhancement and interpretation using facilities at the Geophysical Institute.

There is a continuing opportunity to work with new agencies and personnel to introduce the operational benefits of remote sensing and to upgrade existing users into more extensive and intensive use of these data and state-of-the-art techniques that are available through research activities of the University. During the coming year we expect to provide assistance with remote-sensing technology to the operational agencies of government and industry at a variety of levels in a pattern related to the current year's efforts. These include:

1 - Observation, coordination and information exchange
2 - Training courses and workshops
3 - Data exchange
4 - Consulting services
5 - Data processing services
6 - Cooperative projects

We believe this mix of functions should continue to be effective in meeting the goals of this Grant. It addresses the initial reticence of new users to become deeply involved in a new technology which they only partially understand, but the greatest emphasis should be on activities at level 6. It is only as we become involved with cooperative projects which result in significant decisions or actions that we can

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thoroughly justify the program functions at levels 1 through 5. While important as supporting roles, they more properly are viewed as supporting elements of cooperative projects.

One option to implement an effective level of inter-agency contact with satellite technology would be the establishment of a statewide remote-sensing center which could be supported and run by participating state and federal agencies on a cooperative basis. Such a center could provide for shared-cost, easily accessible to data, facilities for data processing, a quick-look capability, and on-going assistance. Participating users would contribute a modest, on-going commitment without assuming a high risk or cost burden. Communication between users would be enhanced owing to the synergistic effects of cooperative participation. This would be the ideal, long-term goal which would provide the most overall benefit to NASA, the technology of remote-sensing, the State of Alaska, and federal and regional agencies. The scope of effort involved in establishing a regional data center for remote sensing appears to exceed the purpose of this grant so other means should be sought to pursue the data-center concept. If such a data center successfully established would serve the same goals as this grant,it could ultimately take its place.

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APPENDIX A

LIST OF PUBLICATIONS

supported in part by Grant NGL 02-001-092

Anderson, J. H. and A. E. Belon, A new vegetation map of the Western Seward Peninsula, Alaska, Based on ERTS-1 Imagery, Scientific Report on NASA Contract NAS 5-21833, Institute of Arctic Biology and Geophysical Institute, University of Alaska, 1973.

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APPENDIX B

CATALOG OF ALASKAN LANDSAT DATA

July 1972 - June 30, 1976

Prepared by:
Remote-Sensing Library
Geophysical Institute
University of Alaska
Fairbanks, Alaska 99701

LANDSAT DATA

The characteristics of the Landsat system are summarized in the attached table.

The data coverage maps locate the scene identification number of all Landsat images which are currently available in the remote-sensing archives in the following formats:

- 70mm positive transparencies of MSS spectral bands 4,5,6 and 7
- 70mm negative transparencies of MSS spectral band 5
- 9½" print of MSS spectral band 7

The more detailed catalog listings give the date of acquisition, approximate cloud cover, geographic center point of the image and the sun elevation and azimuth. A general map description is also included in the listing.

Other formats up to 40"x40" prints (1:250,000 scale) and simulated color-infrared composites can be ordered from the Geophysical Institute photo lab or the EROS Data Center, Sioux Falls, South Dakota. Landsat images in digital magnetic tape format must be ordered from the EROS Data Center.

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LANDSAT SYSTEM CHARACTERISTICS

Altitude of Satellite	915 km (570 miles)			
Type of orbit	circular, sun-synchronous, 99° inclination			
Orbital period	103 minutes			
Orbits per day	14 orbits			
Coverage cycle	18 days			
Time of observation	approx. 1050 AM at 60° to 70° north latitude			
Size of area imaged	185 x 185 km (115 x 115 st. mi. or 100 x 100 naut. mi.)			
Field of view	11.56 x 11.56 degrees			
Sidelap	approximately 67% at 62° north latitude			
Overlap along orbit	10%			
Instrument	Multispectral scanner			
Image distorition	2%			
Ground resoltuion	less than 80 to 120 meters			
Positional accuracy (meters	900 meters			
Scene registration (meters	160 meters			
Spectral Band	4	5	6	7
Spectral bandwidth (microns)	0.5-0.6	0.6-0.7	0.7-0.8	0.8-1.1
Nominal color	Green	Red	Far Red	Near IR

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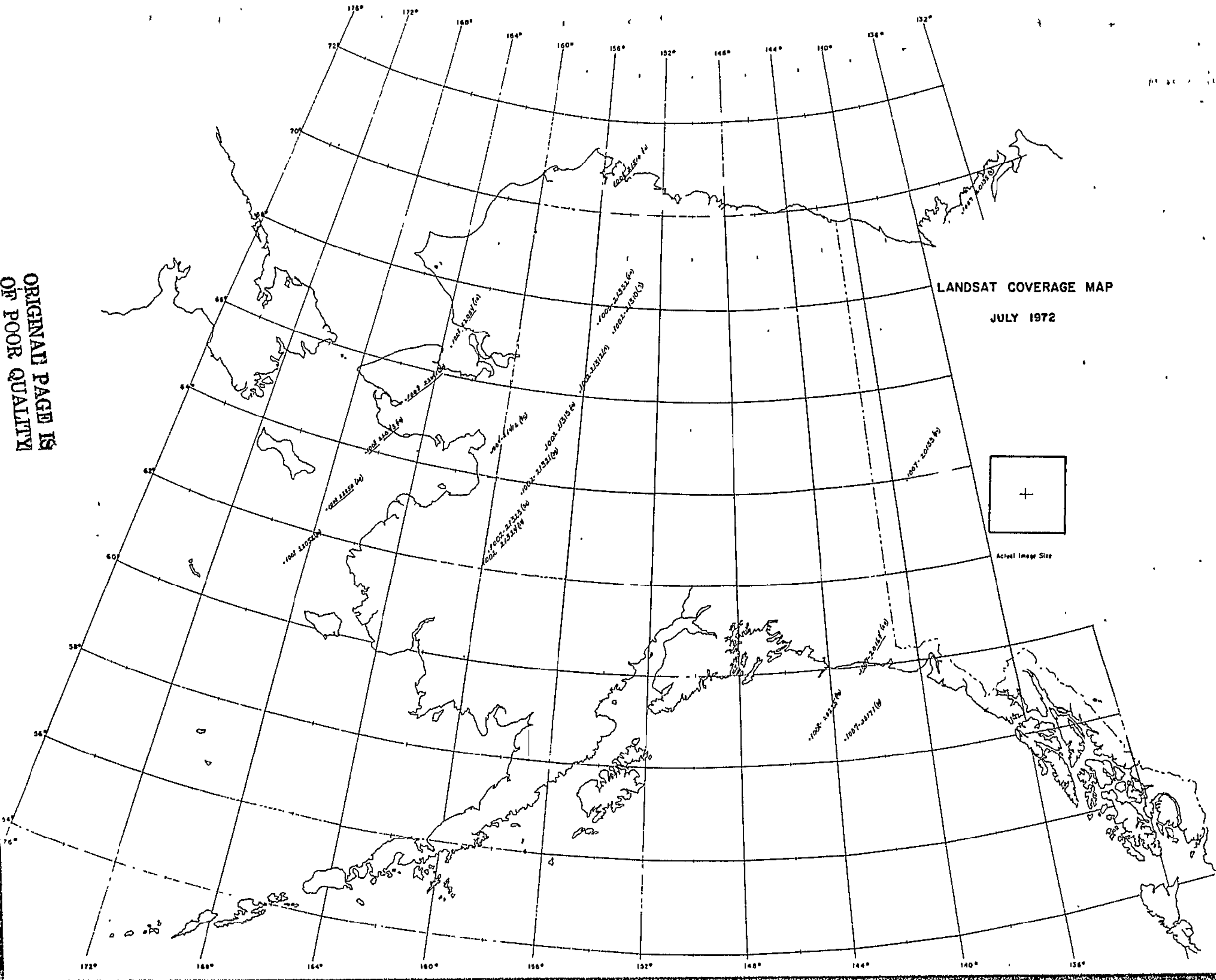

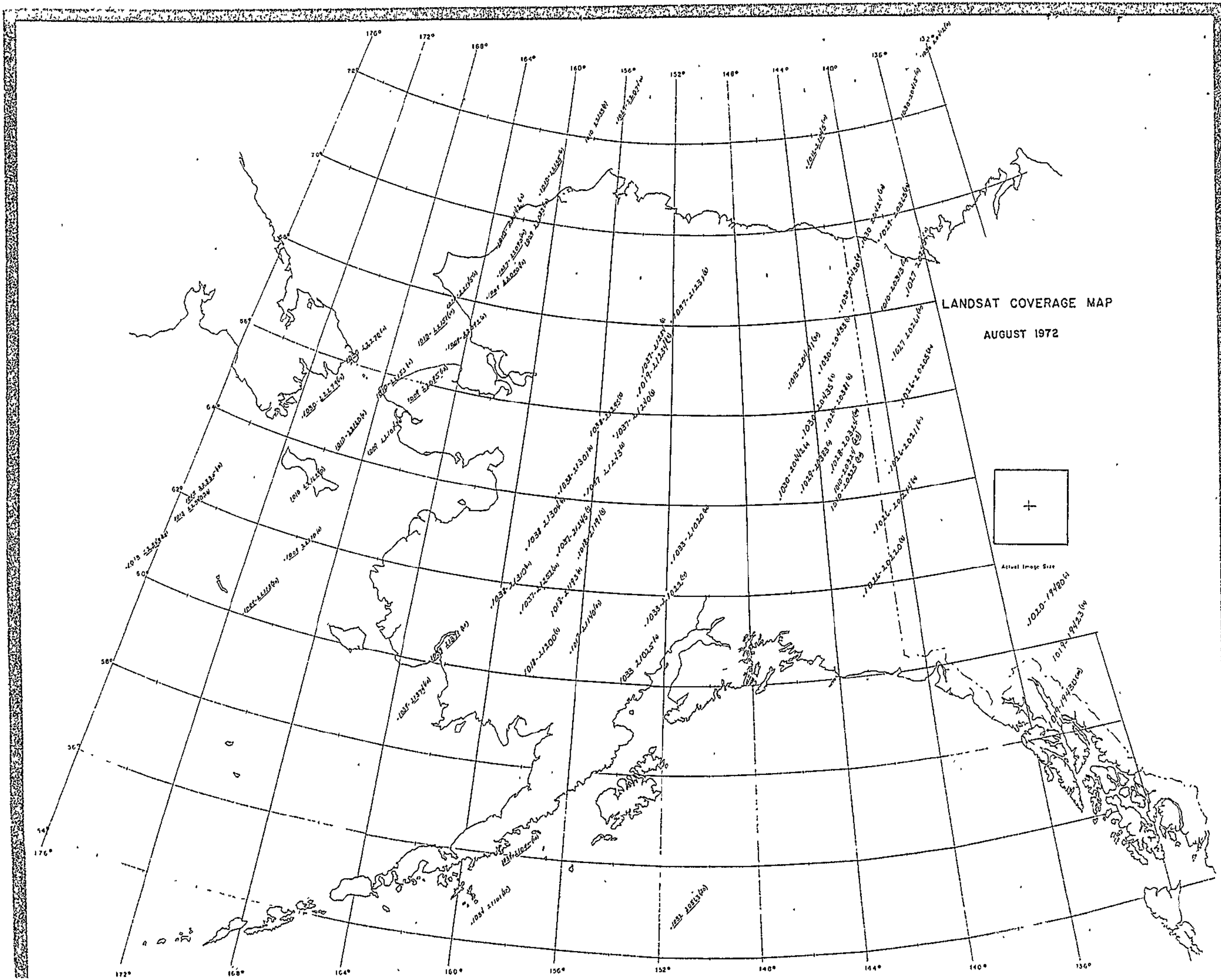

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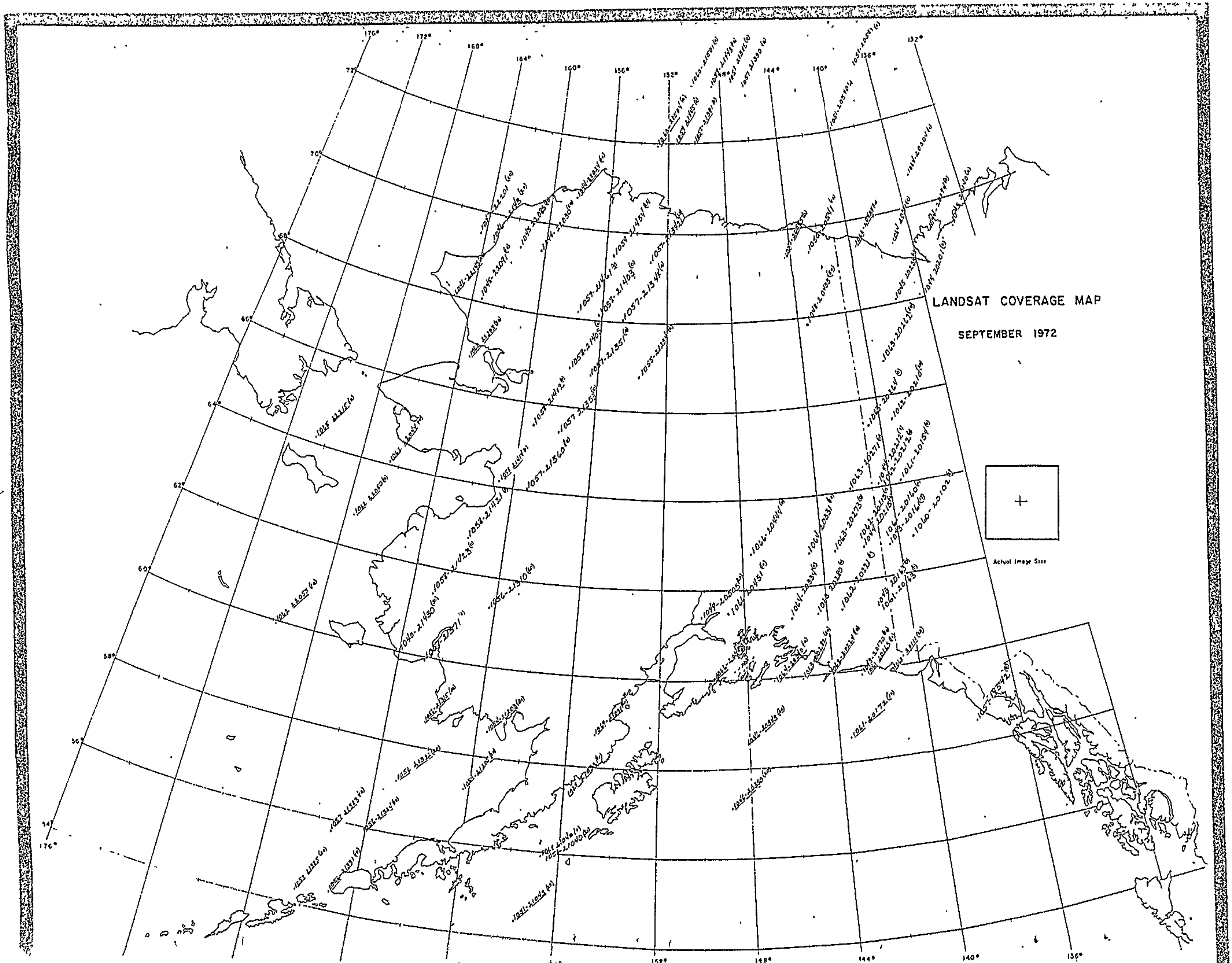
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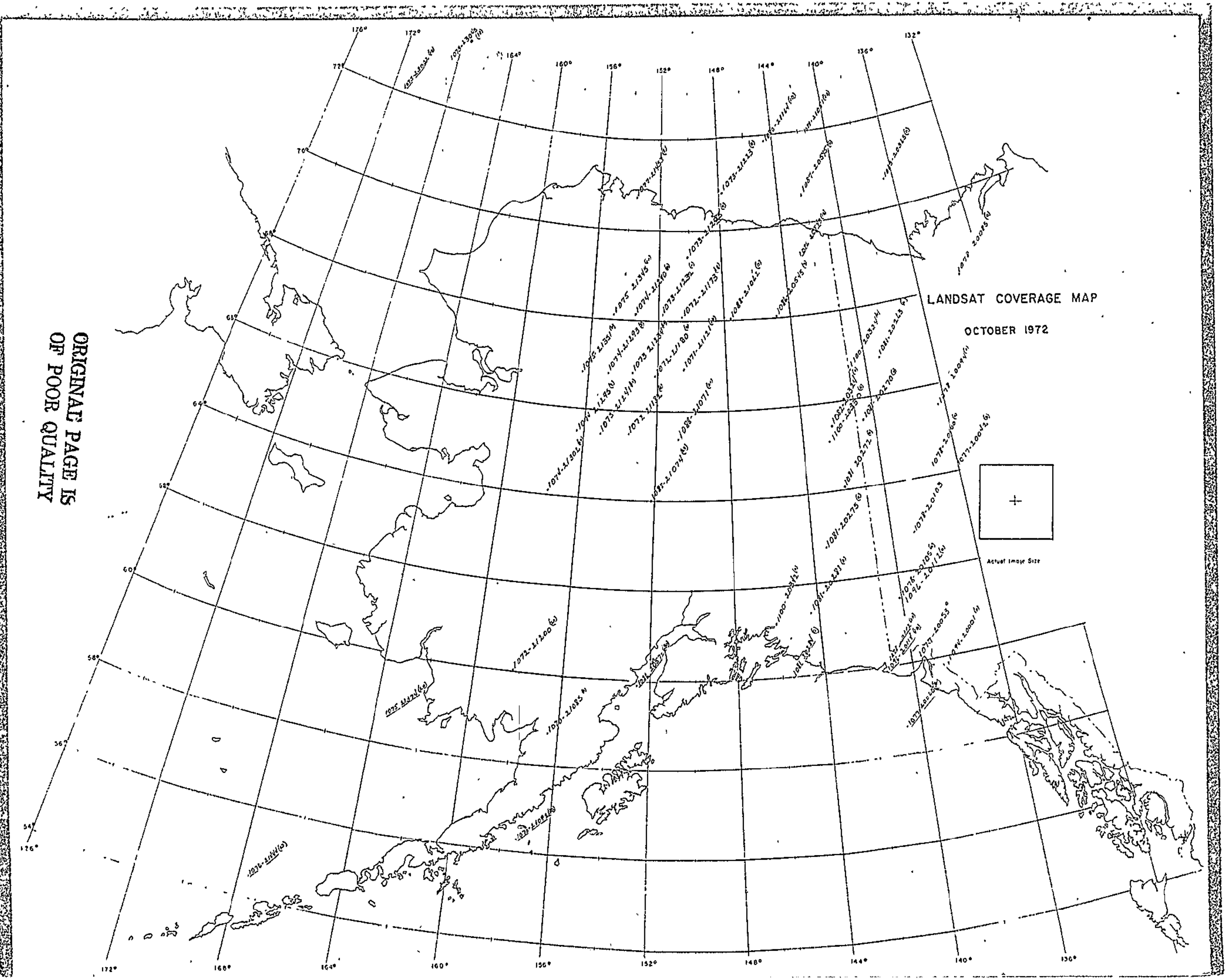

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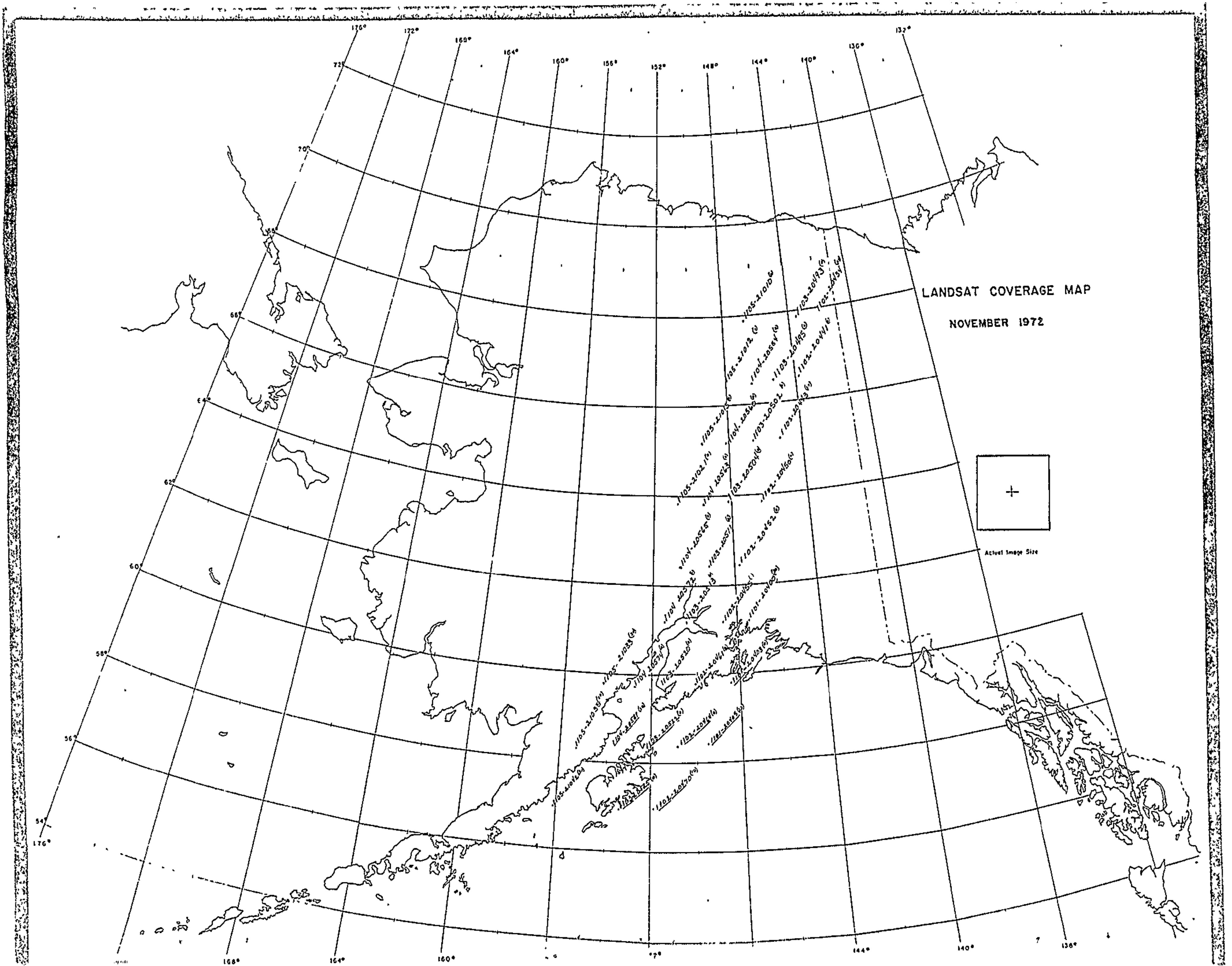

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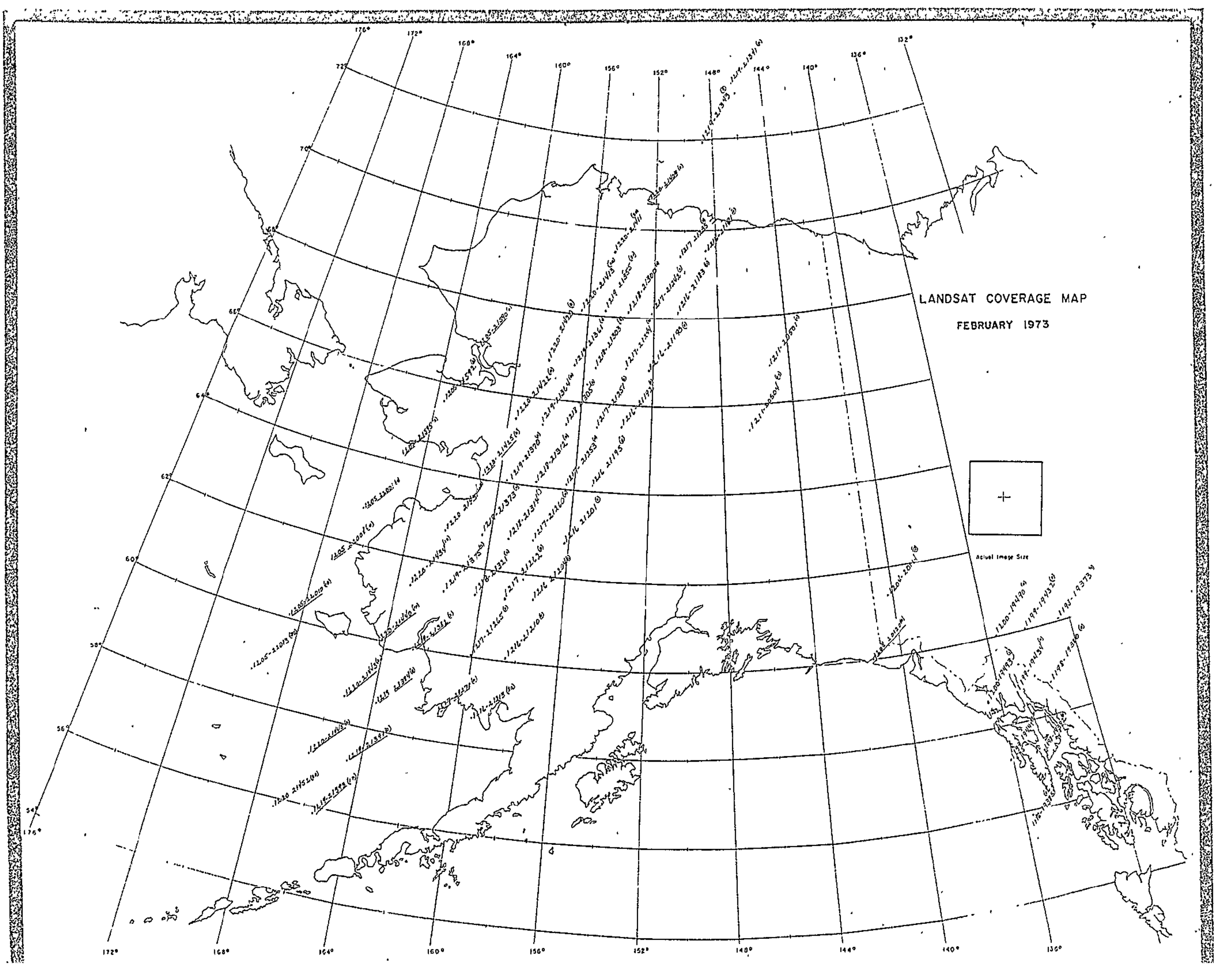
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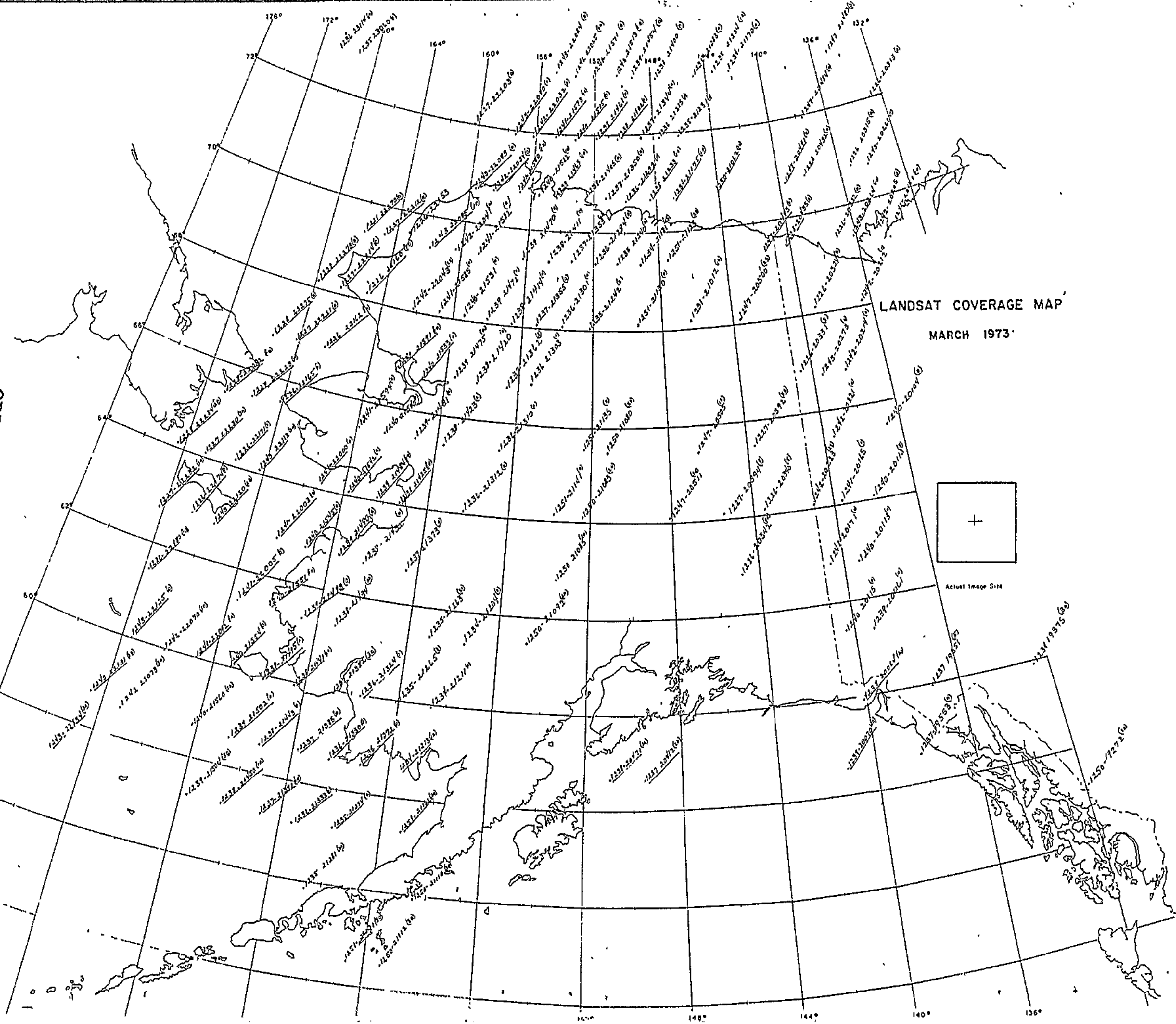

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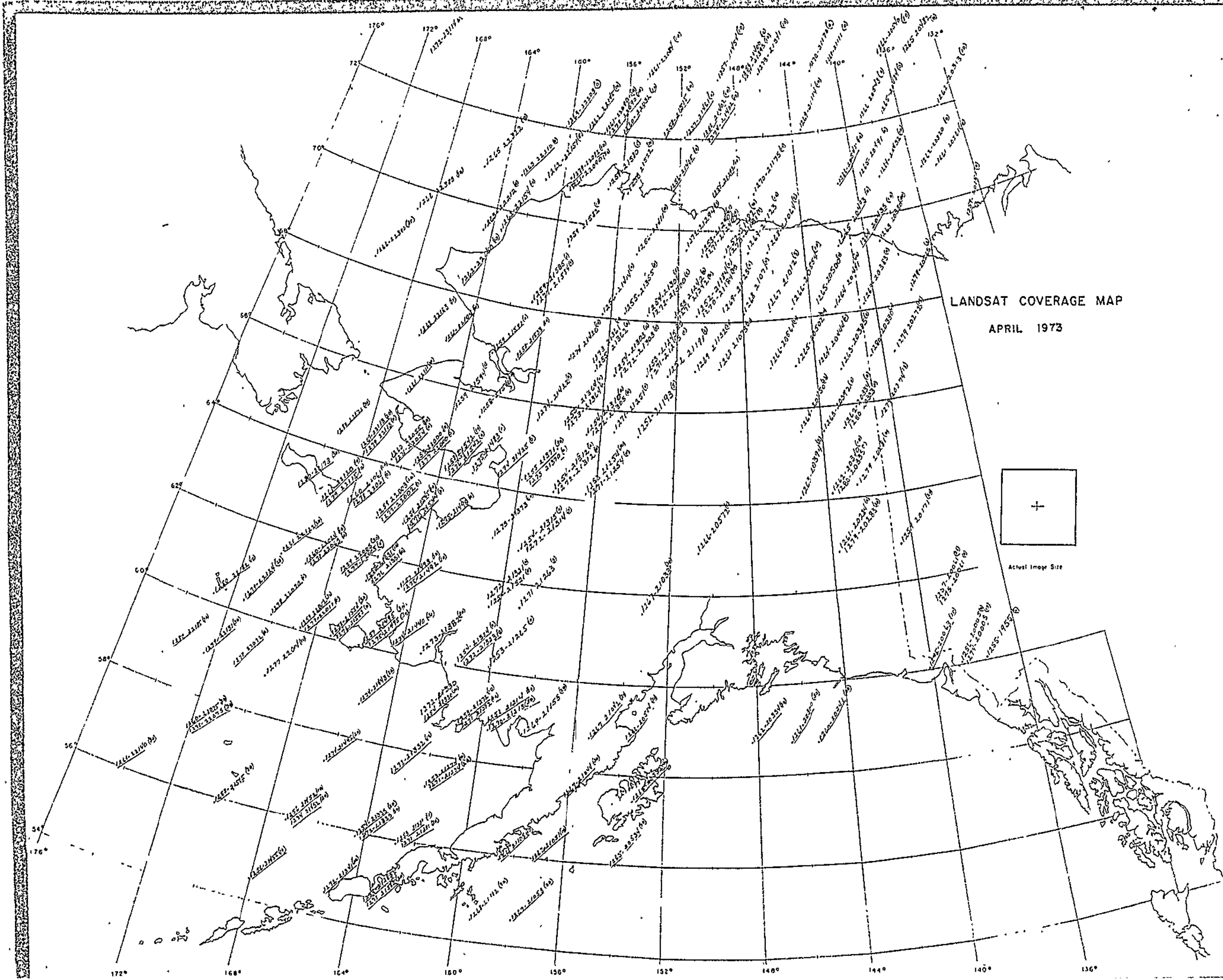
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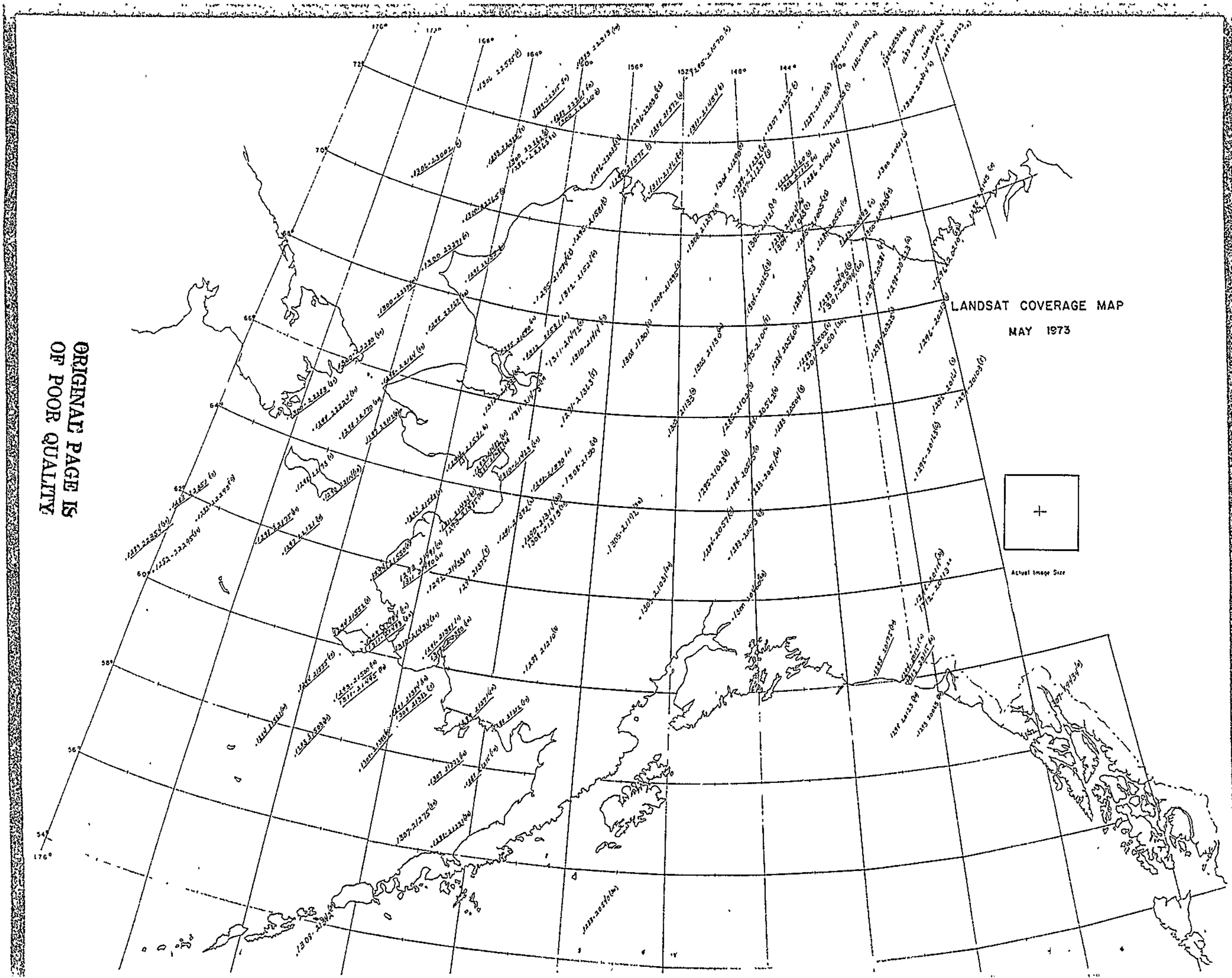

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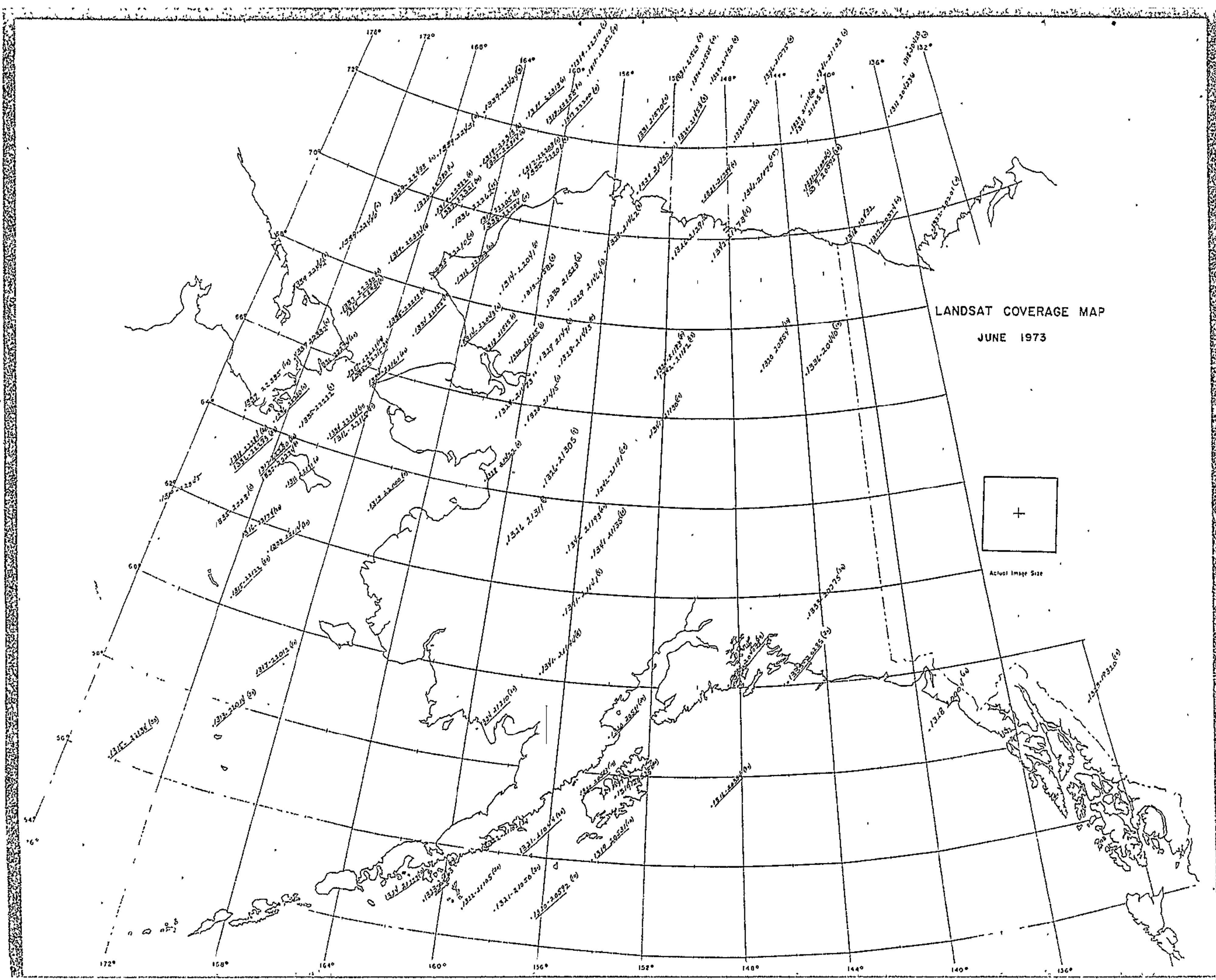
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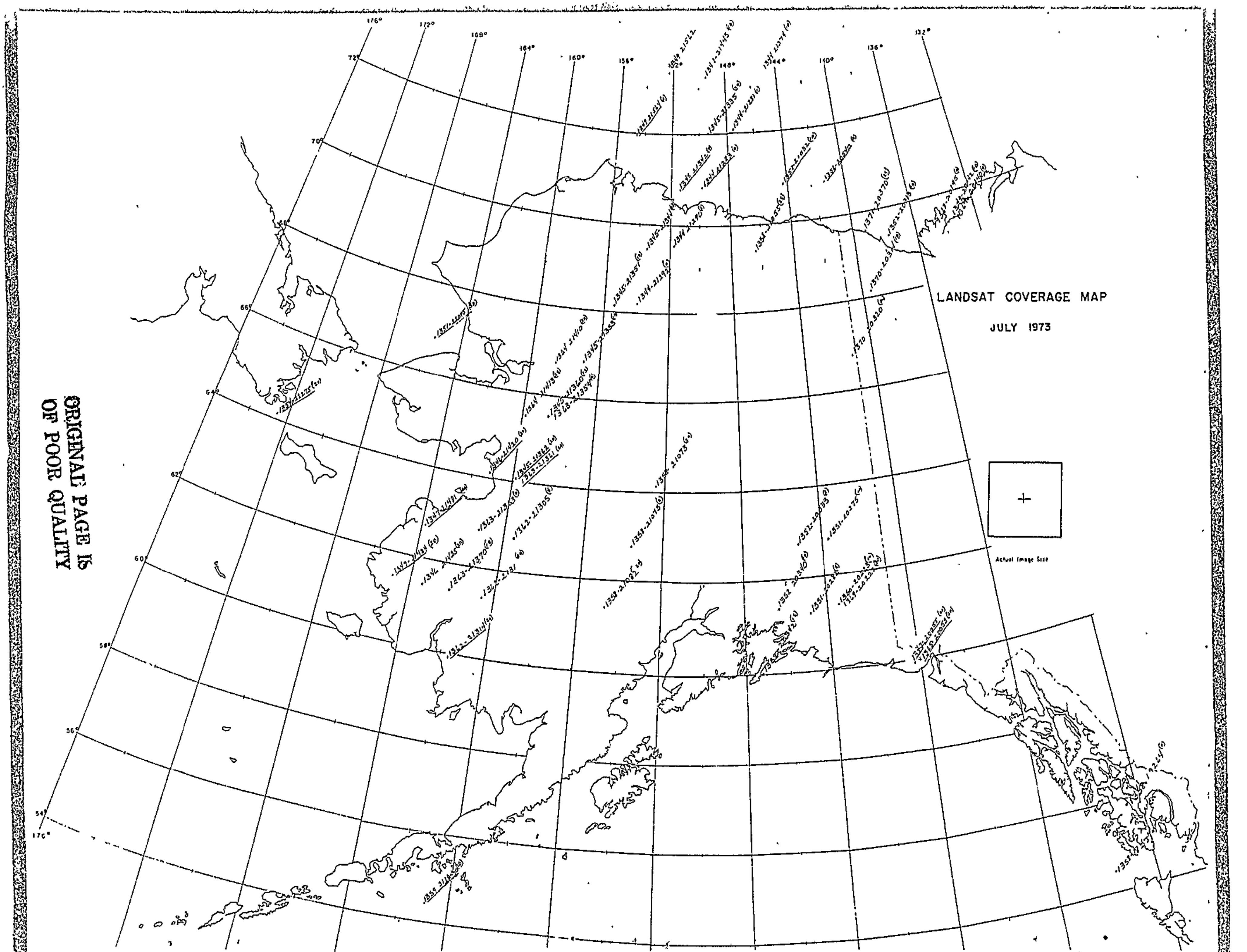

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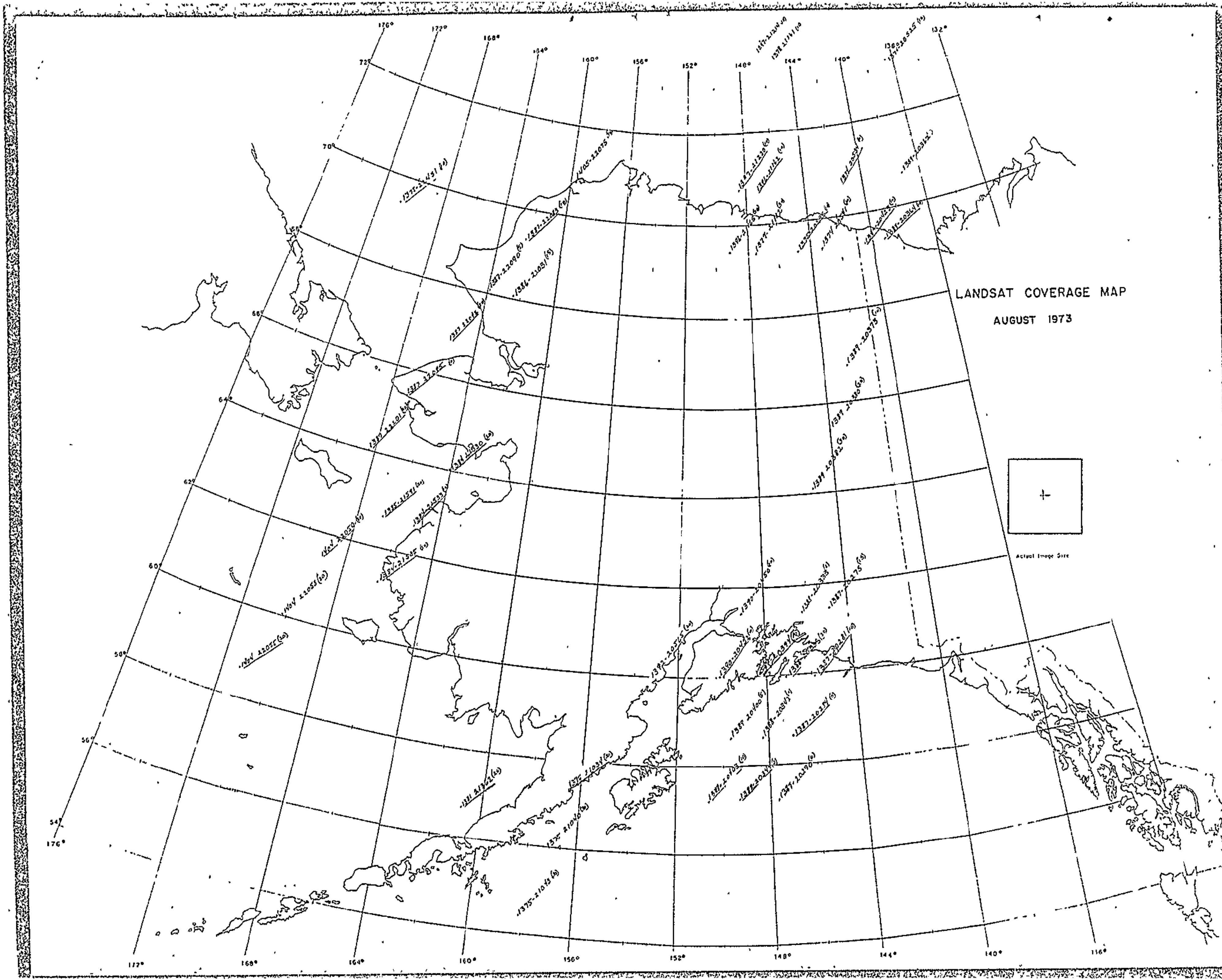

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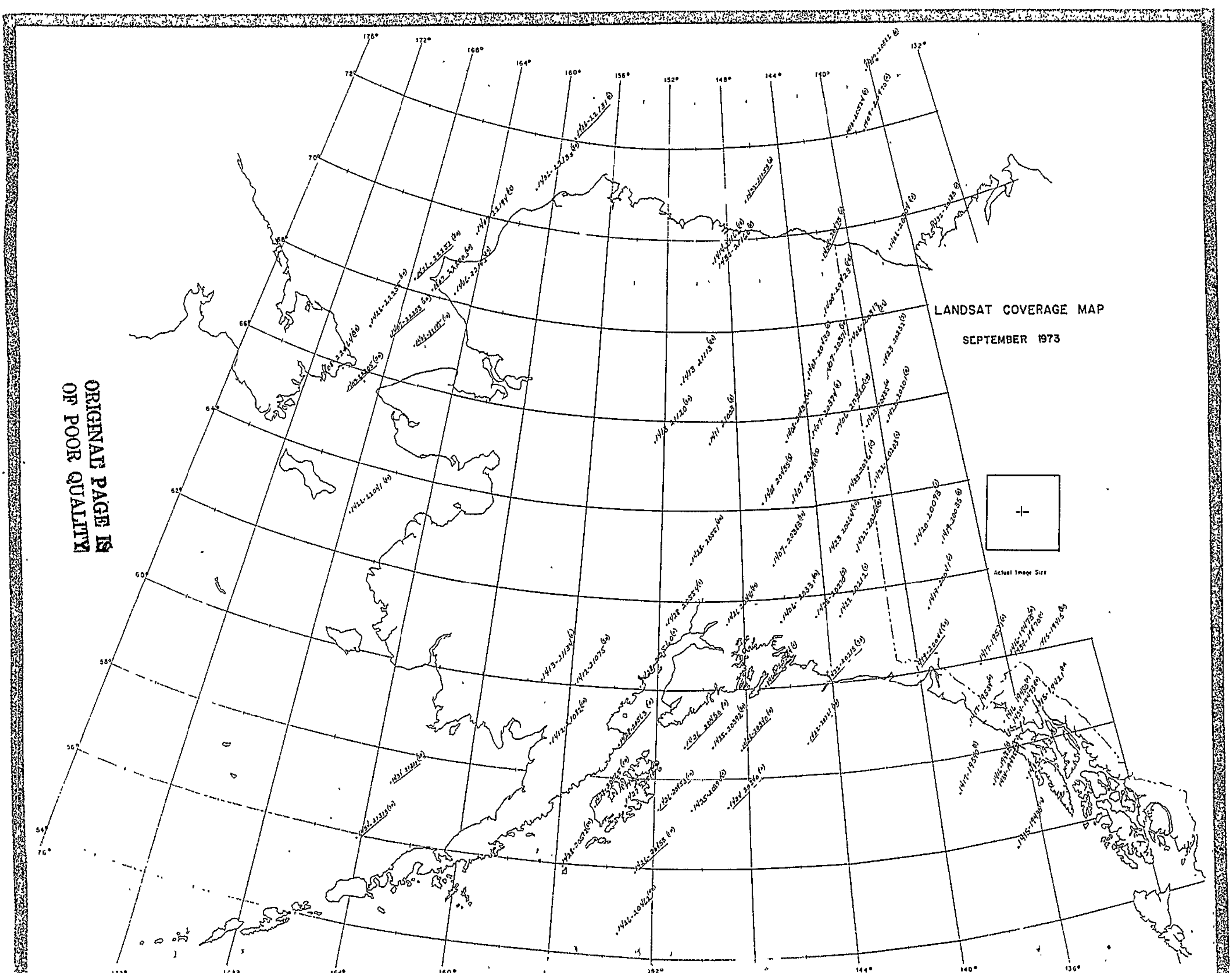

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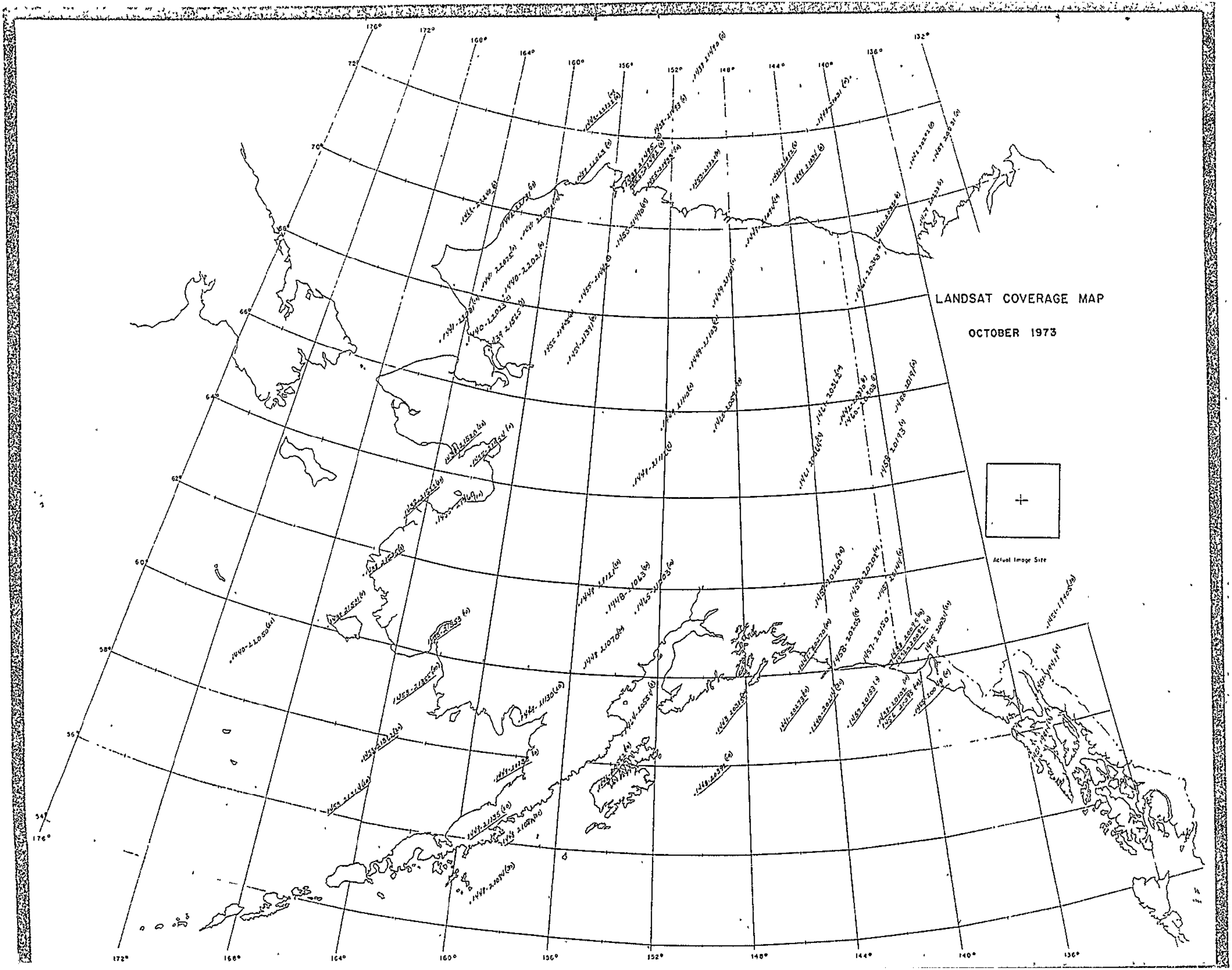
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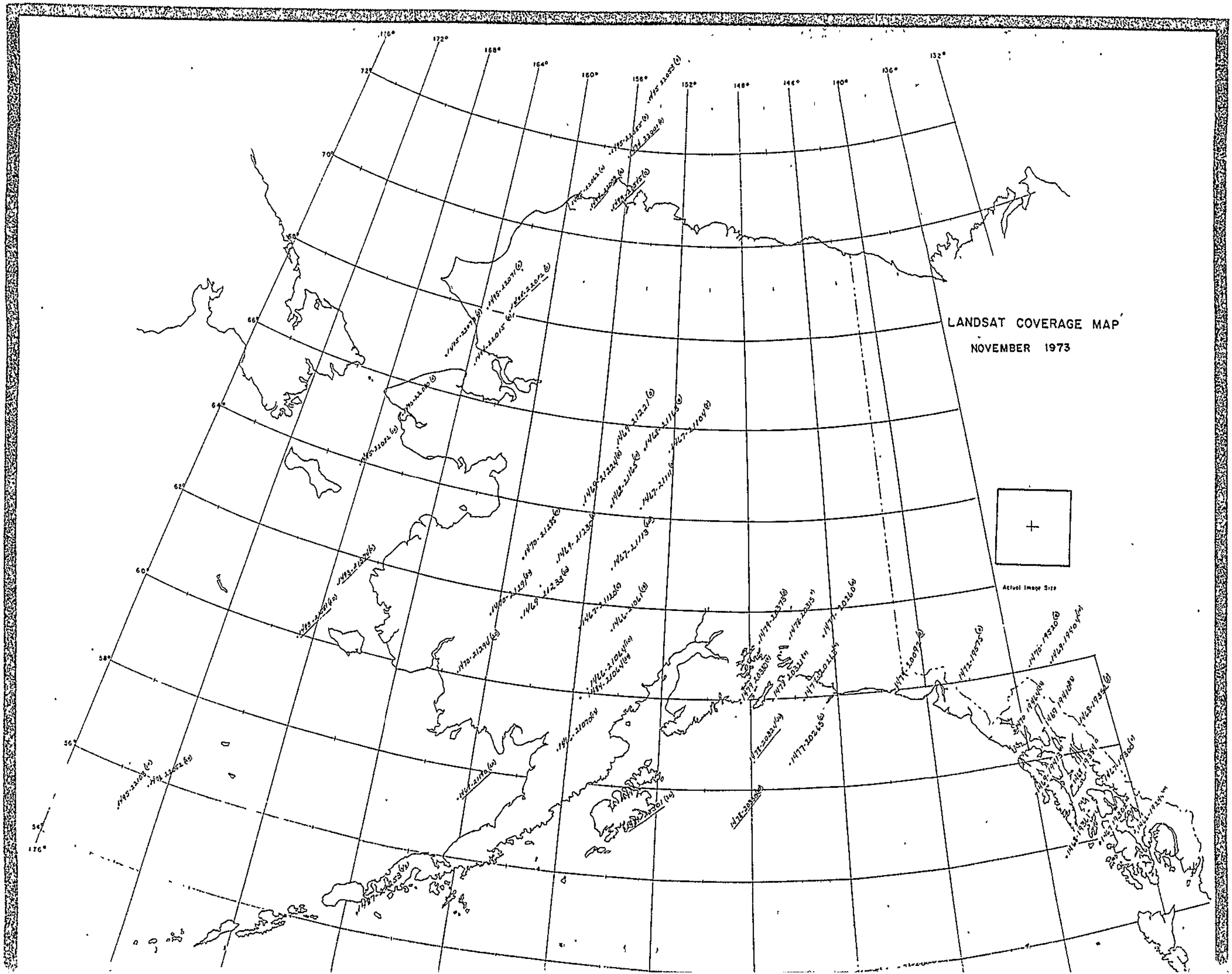
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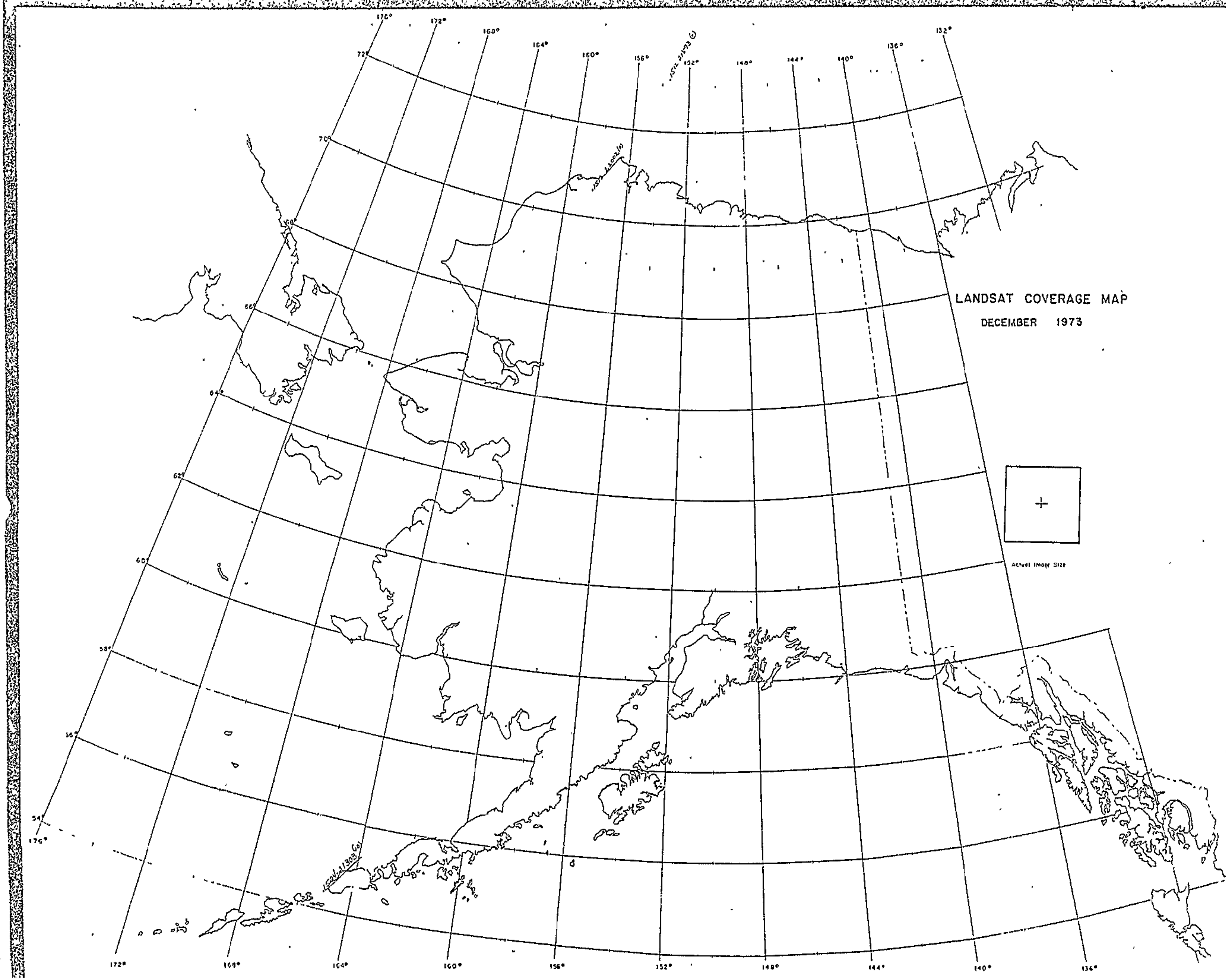

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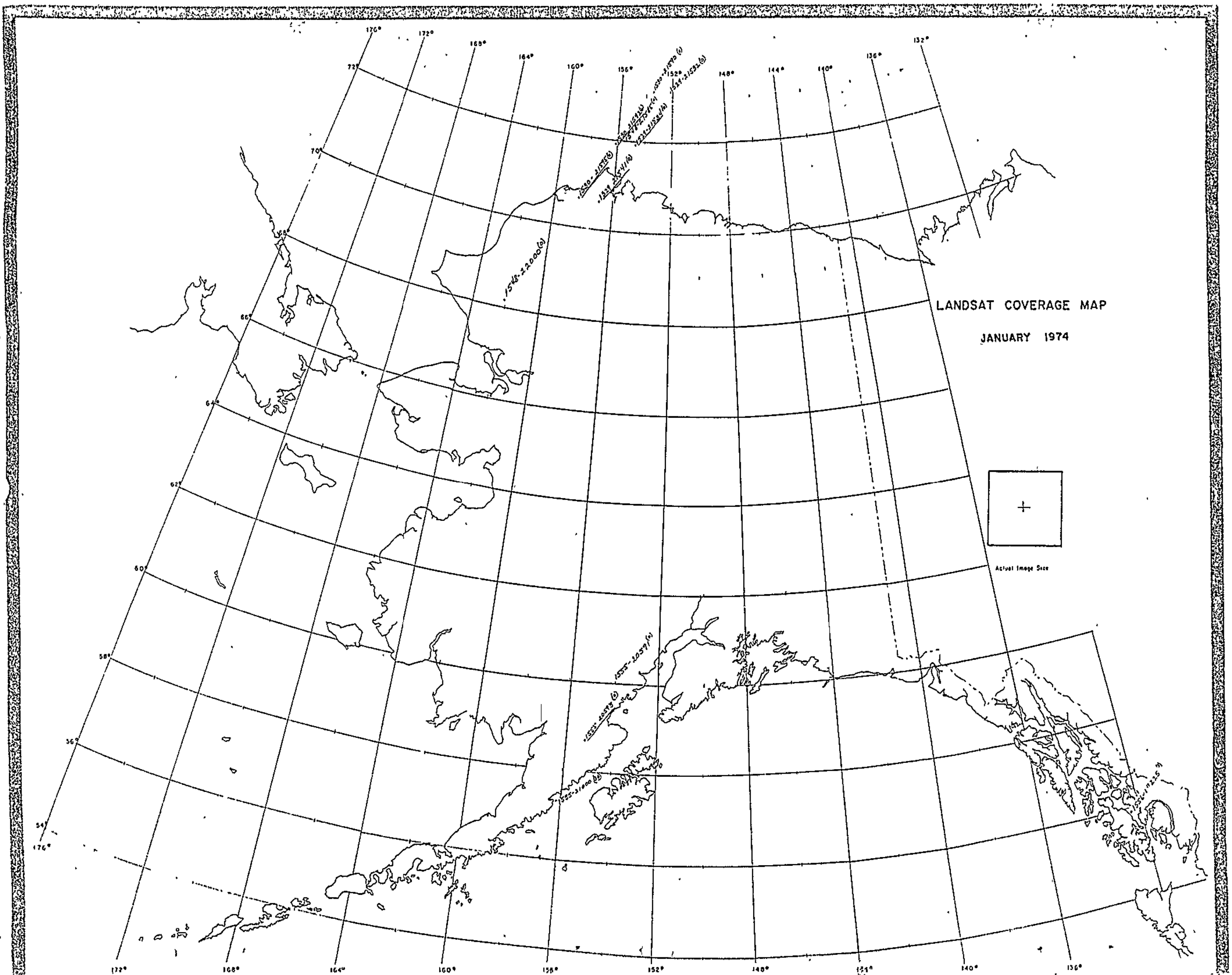
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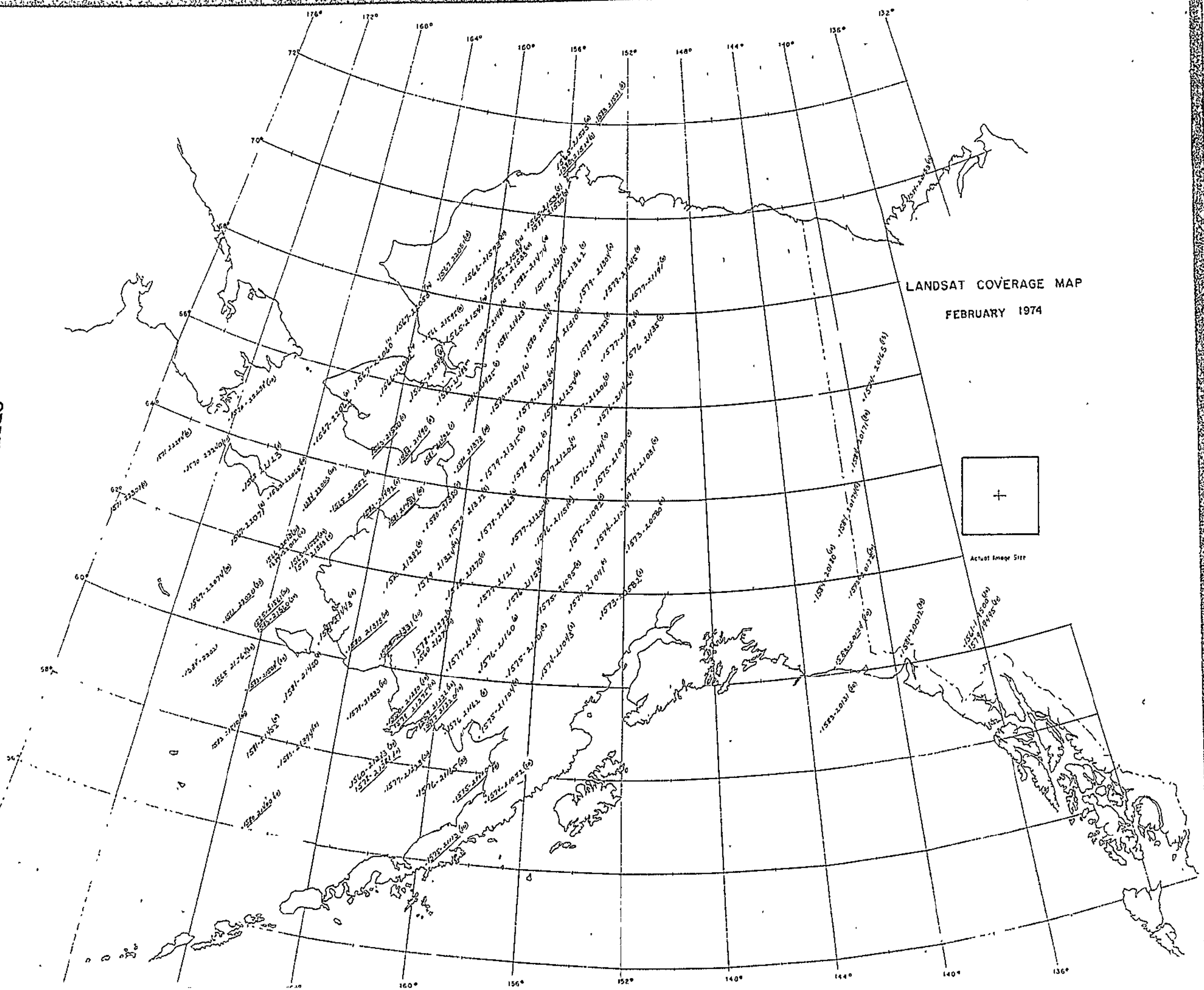

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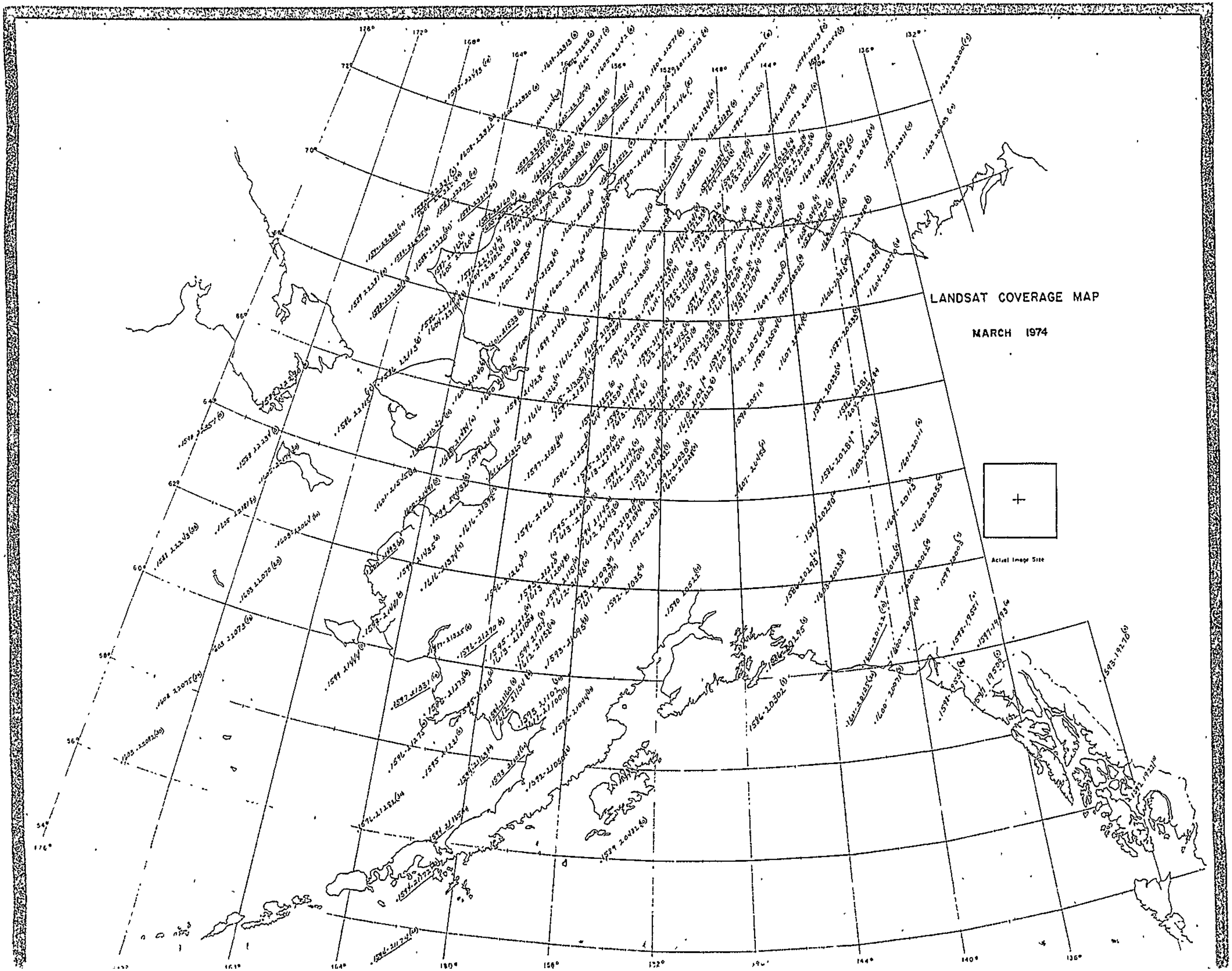

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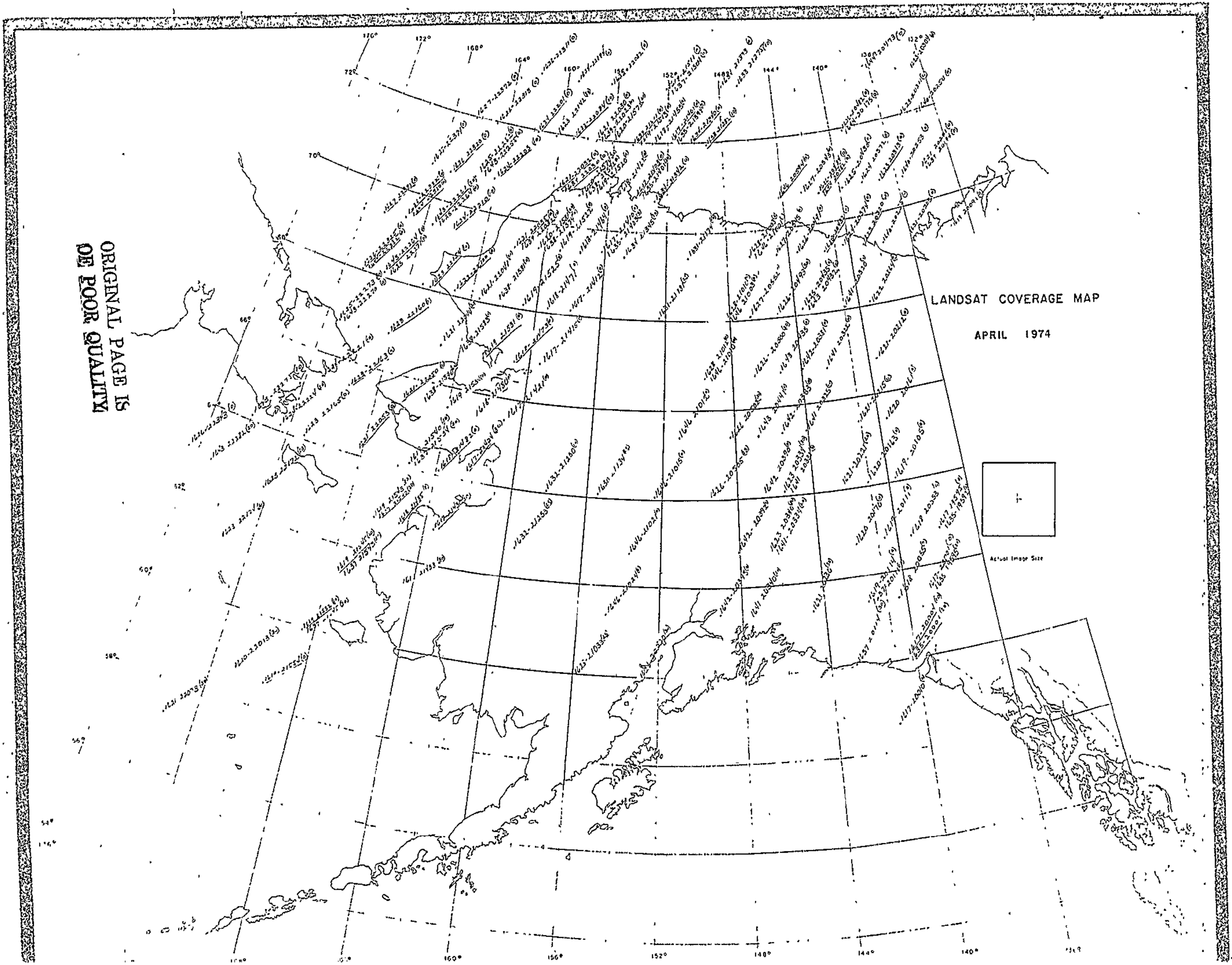

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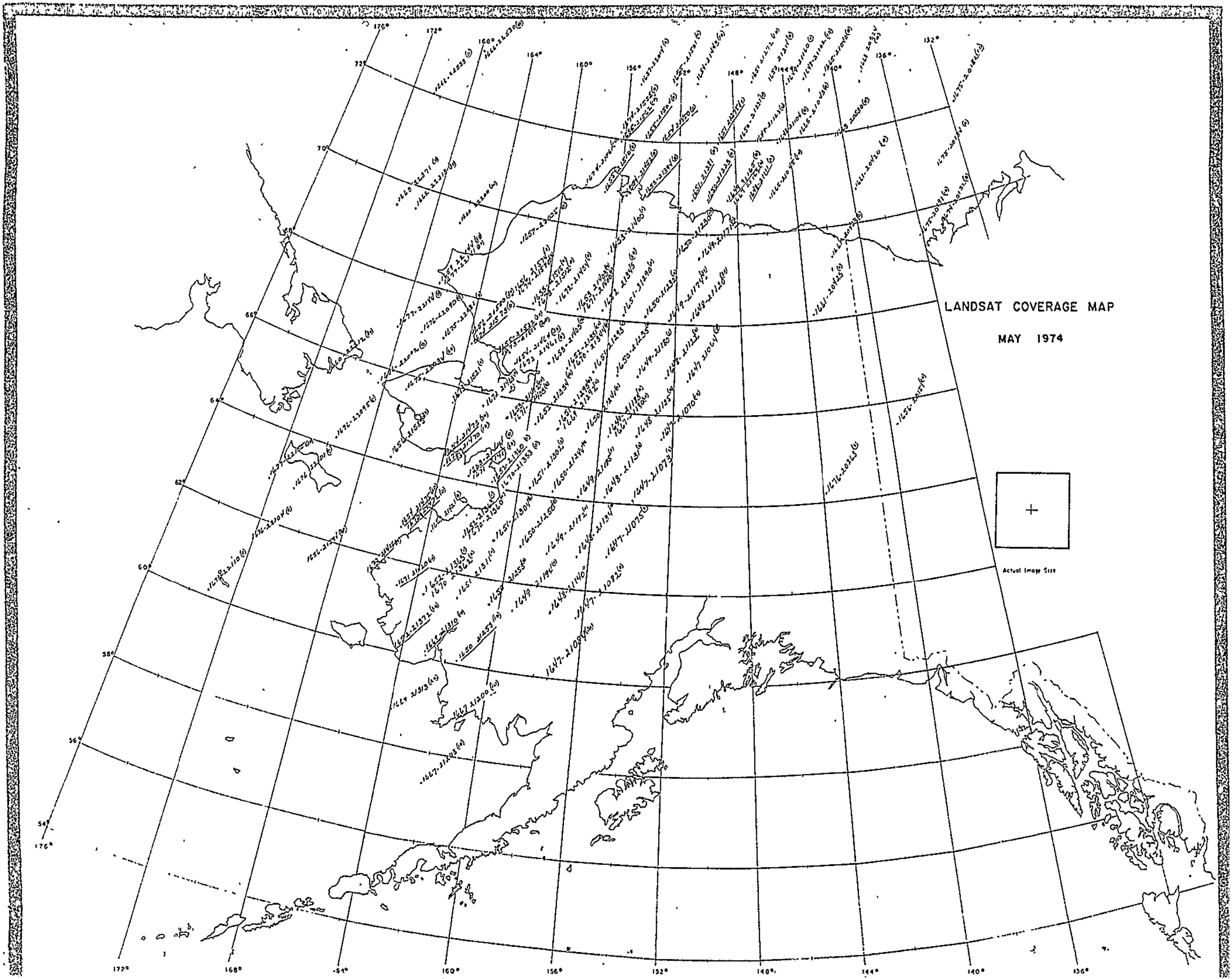

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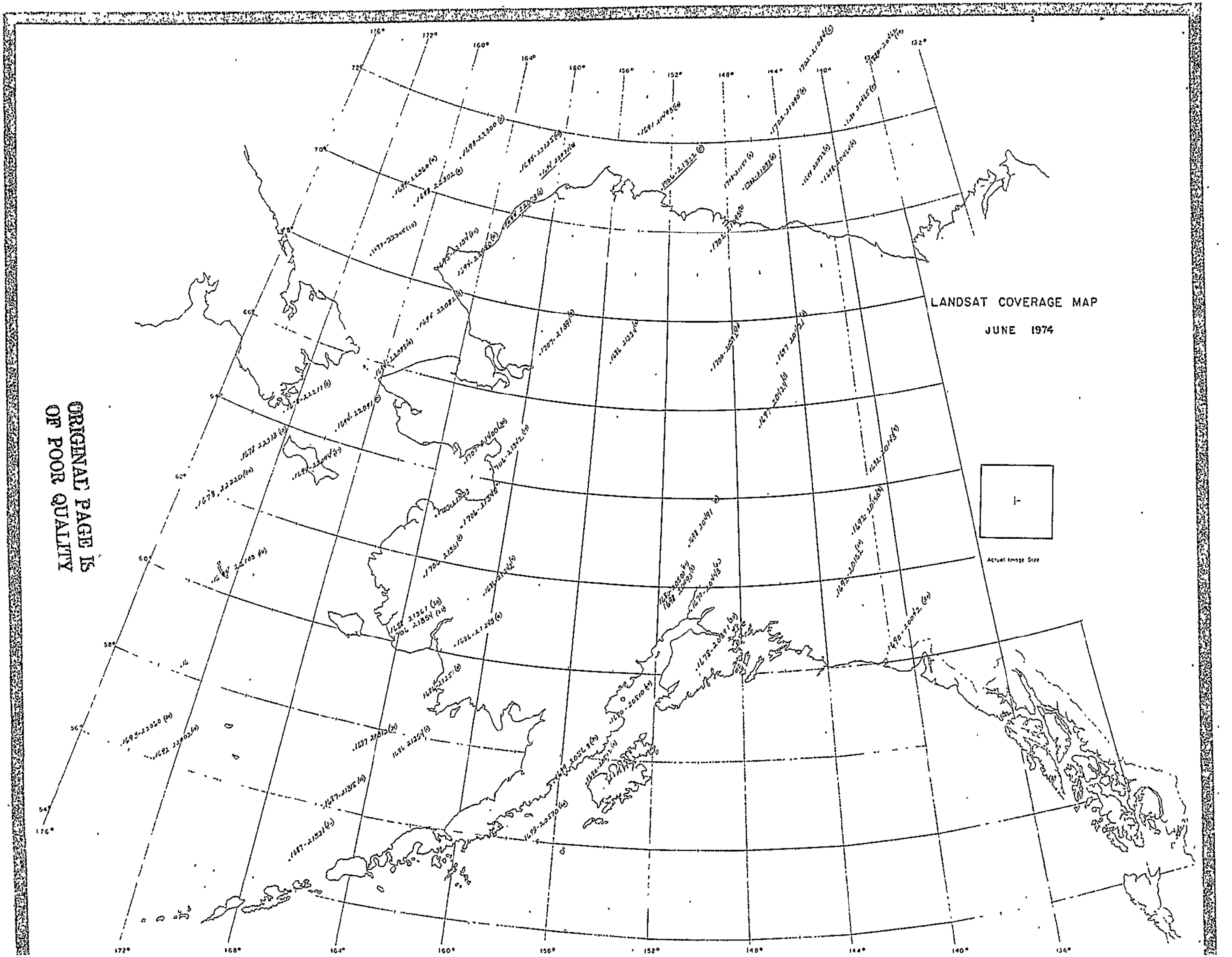

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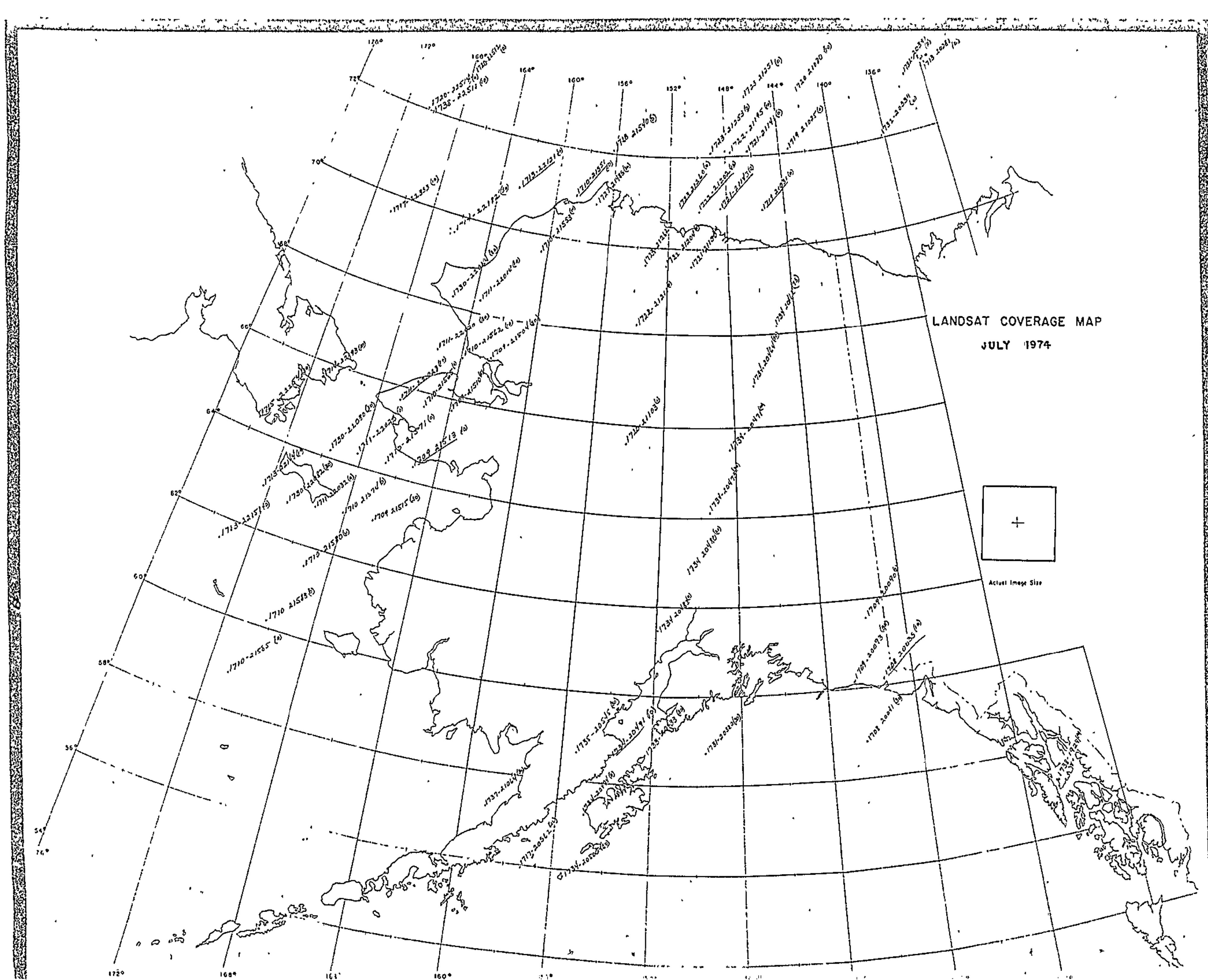
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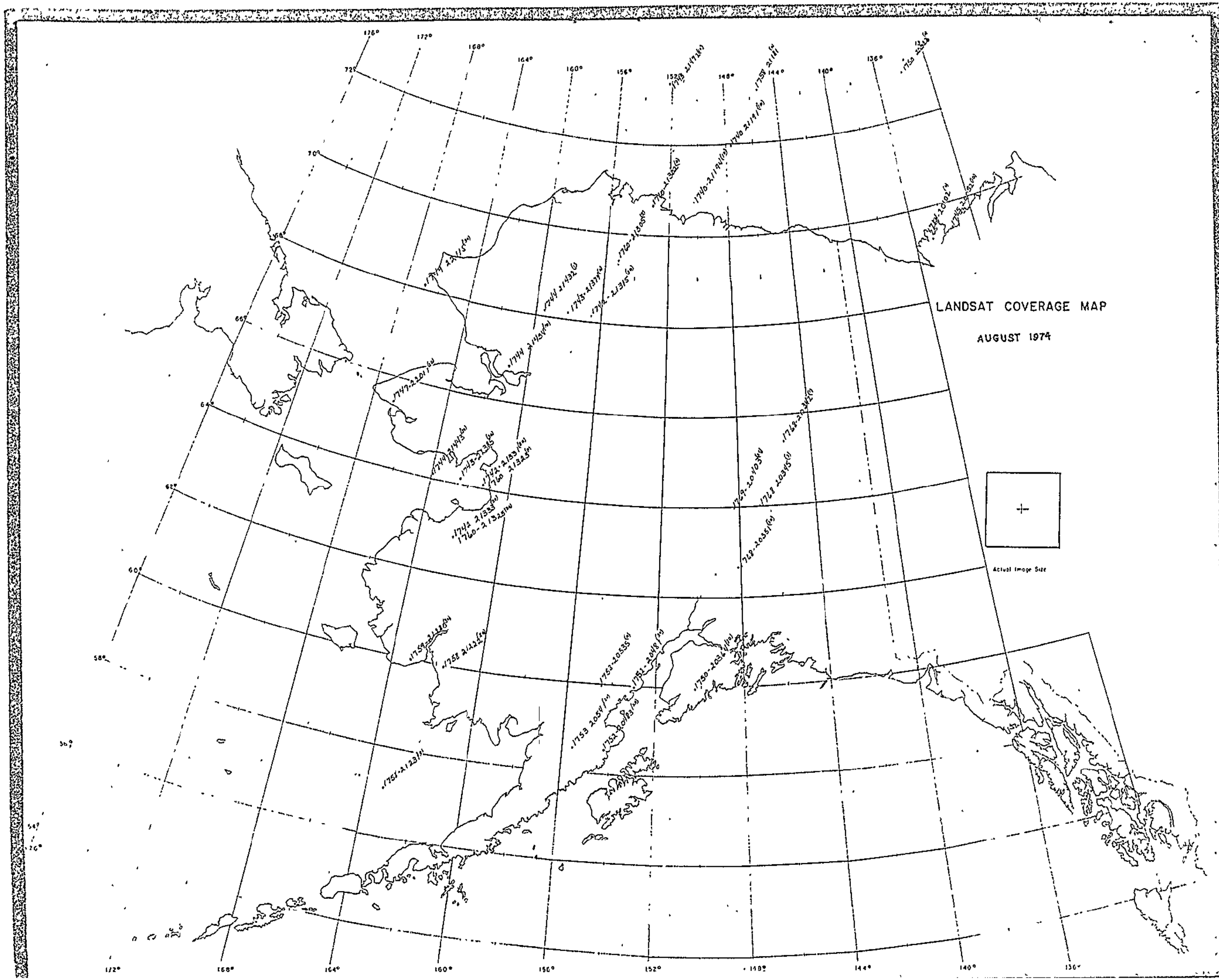
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66°
64°
62°
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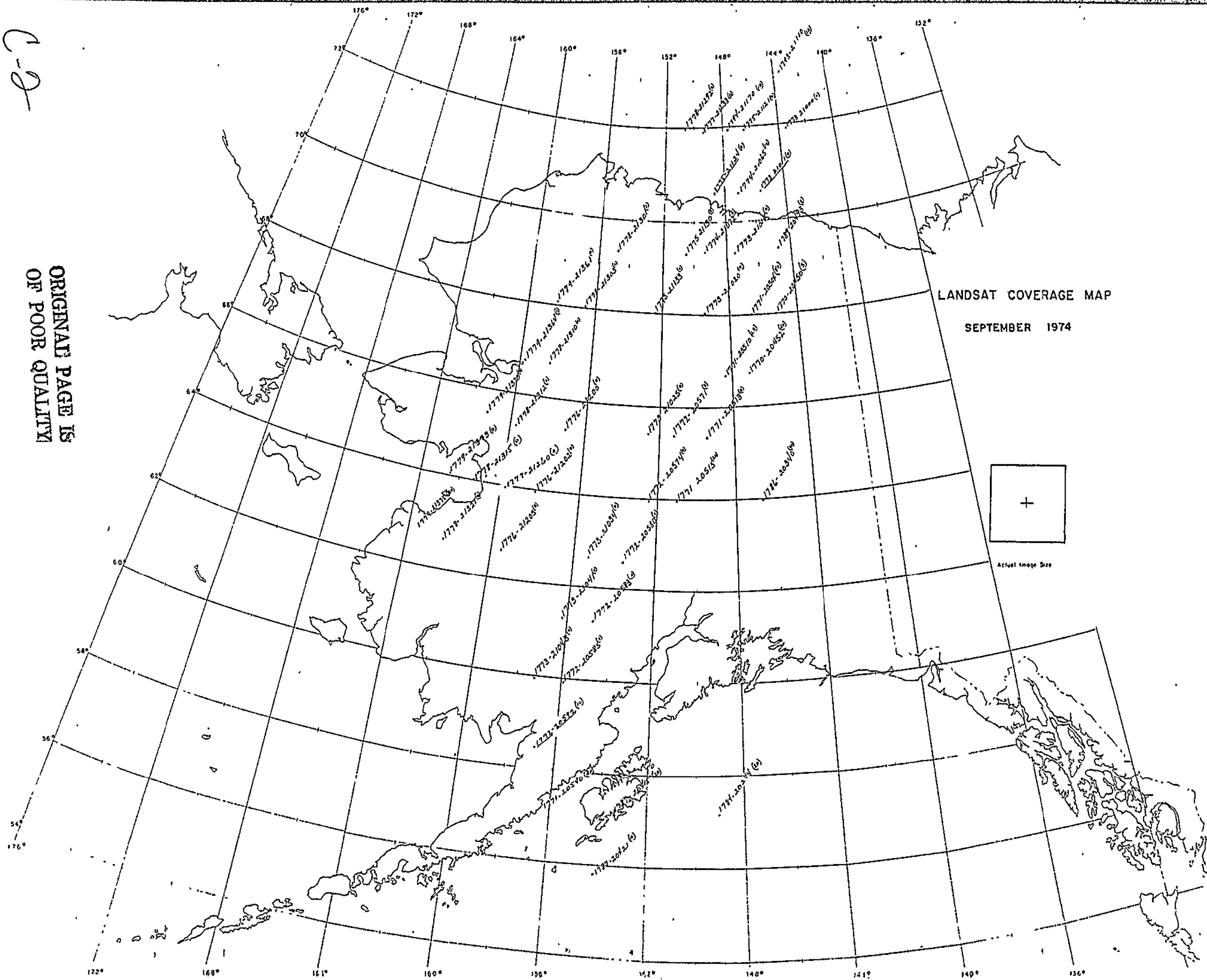

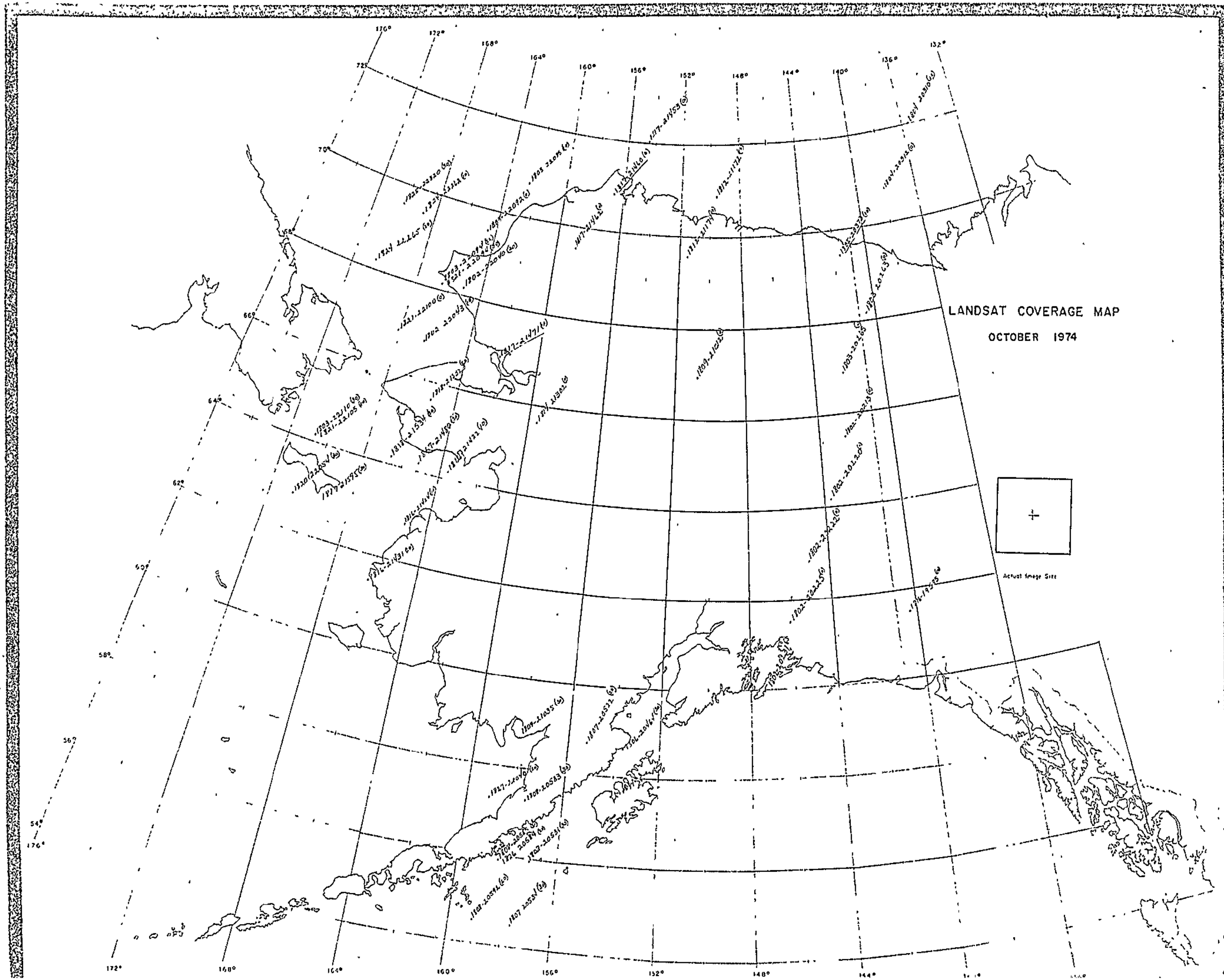
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OCTOBER 1974
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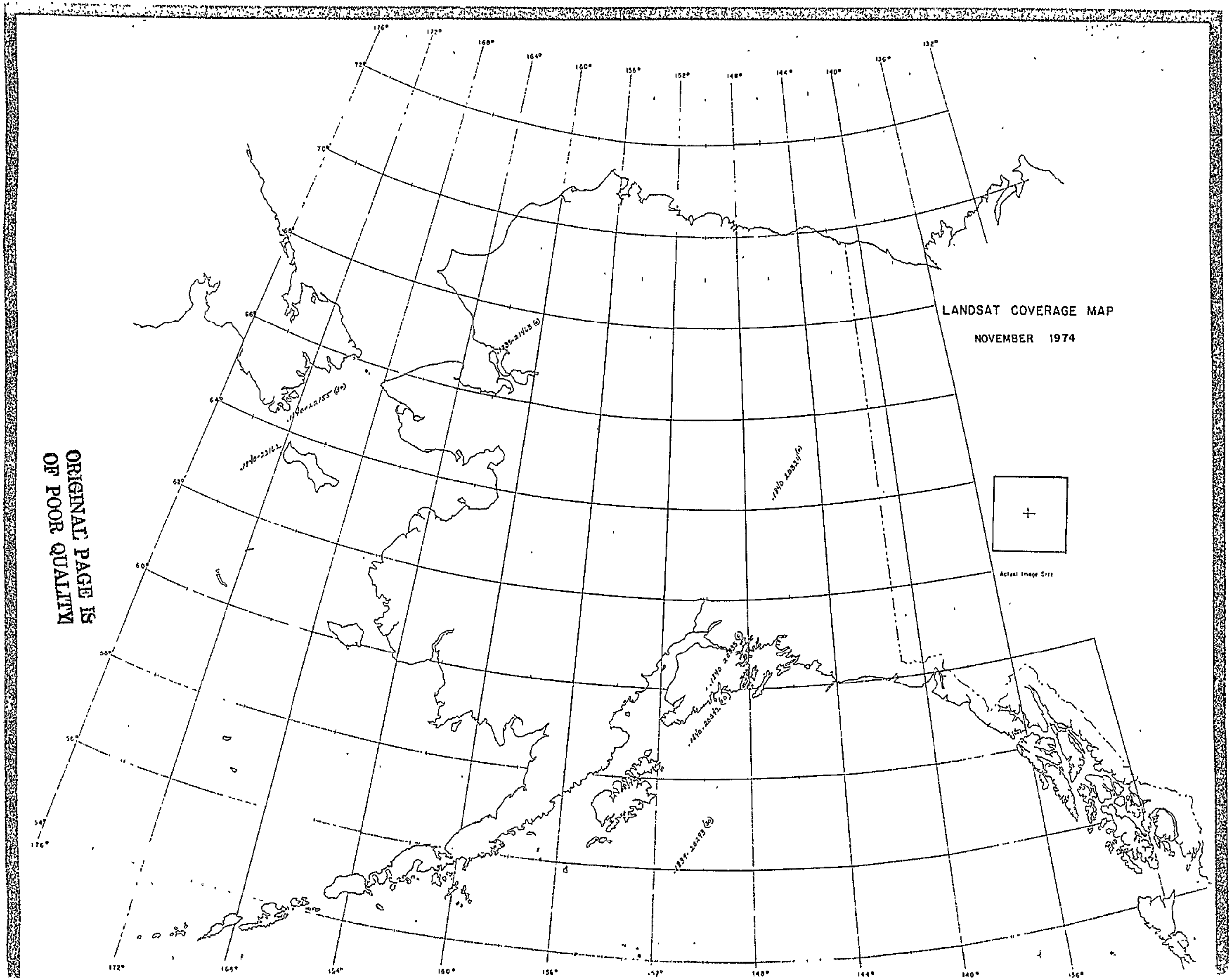

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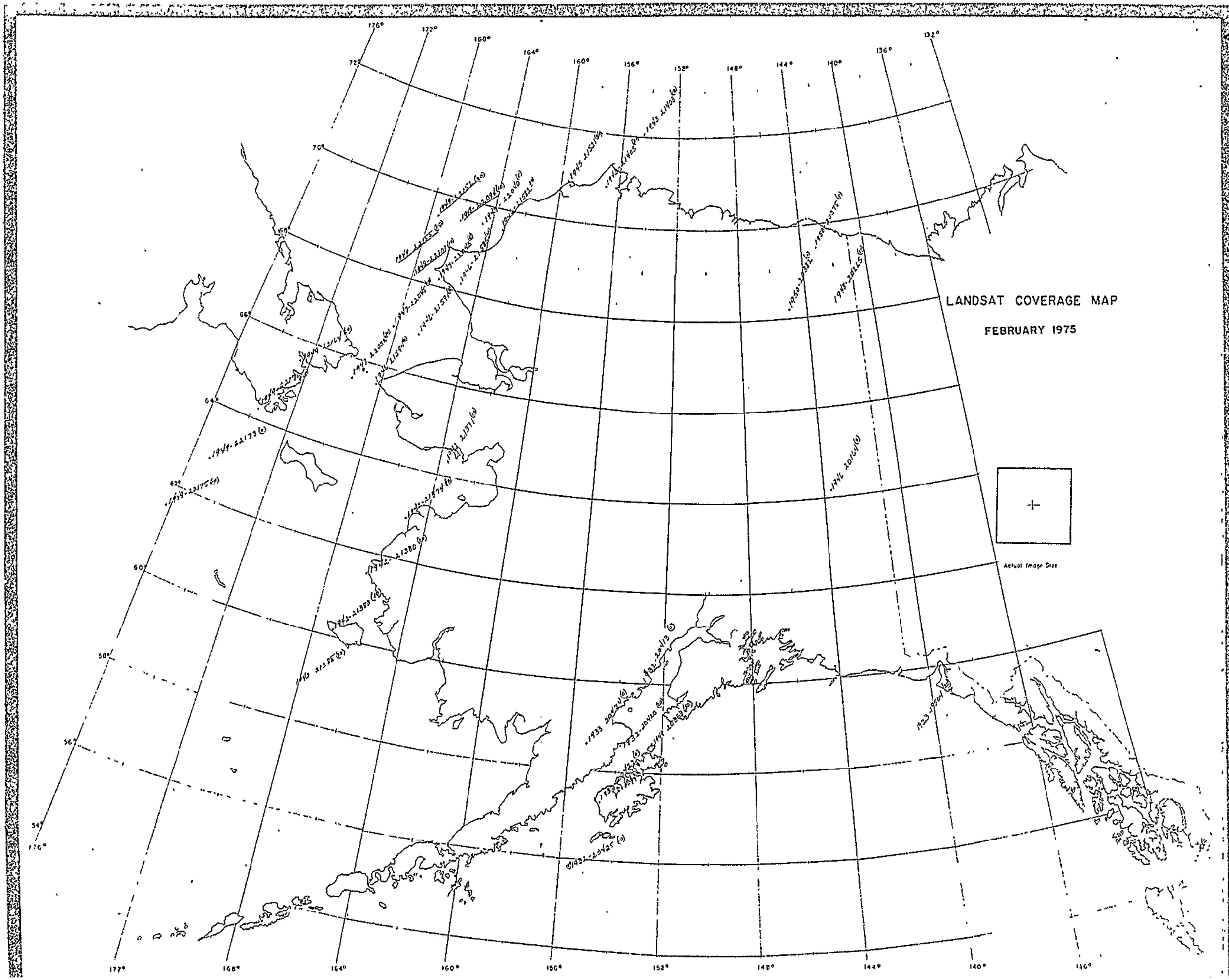
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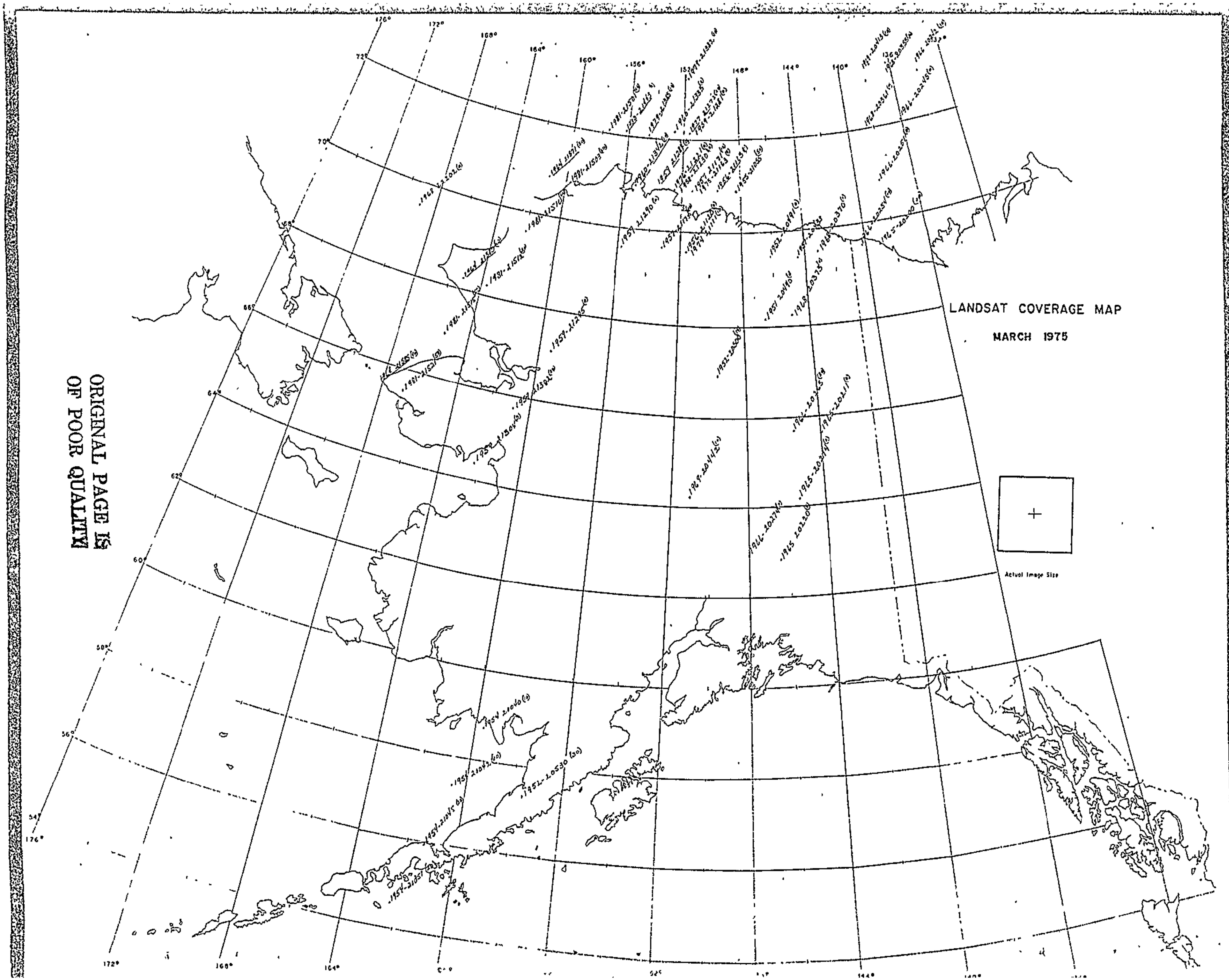

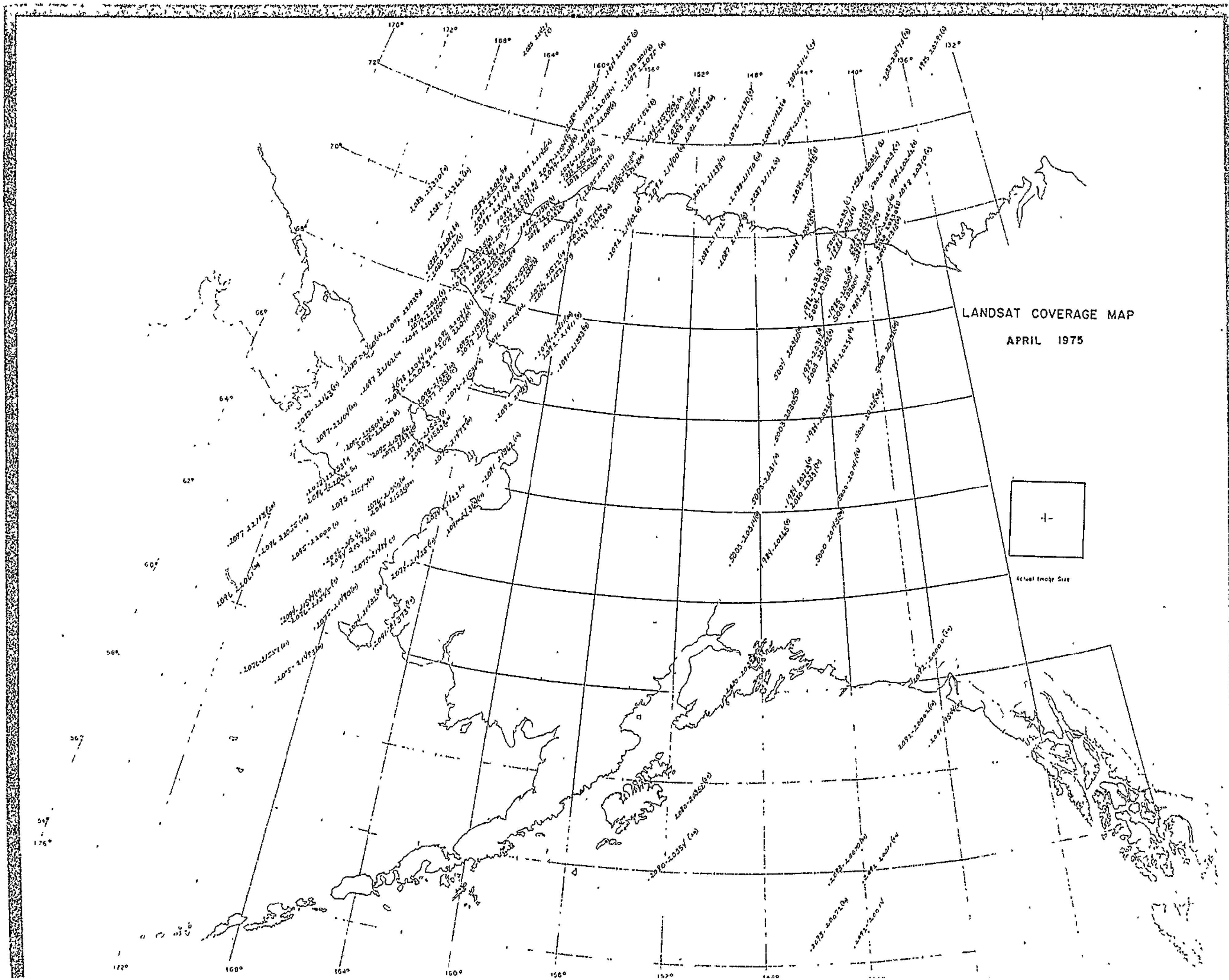
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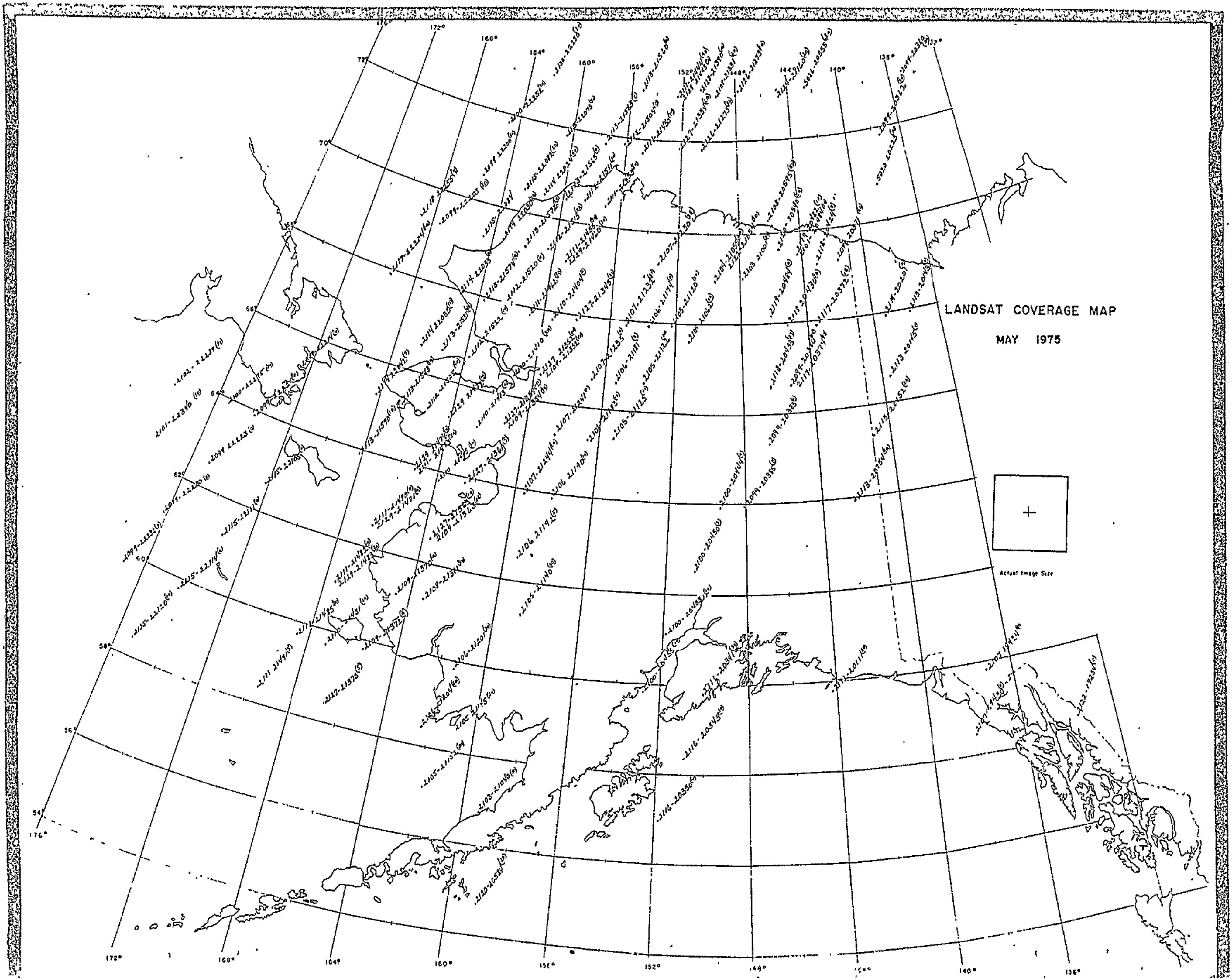
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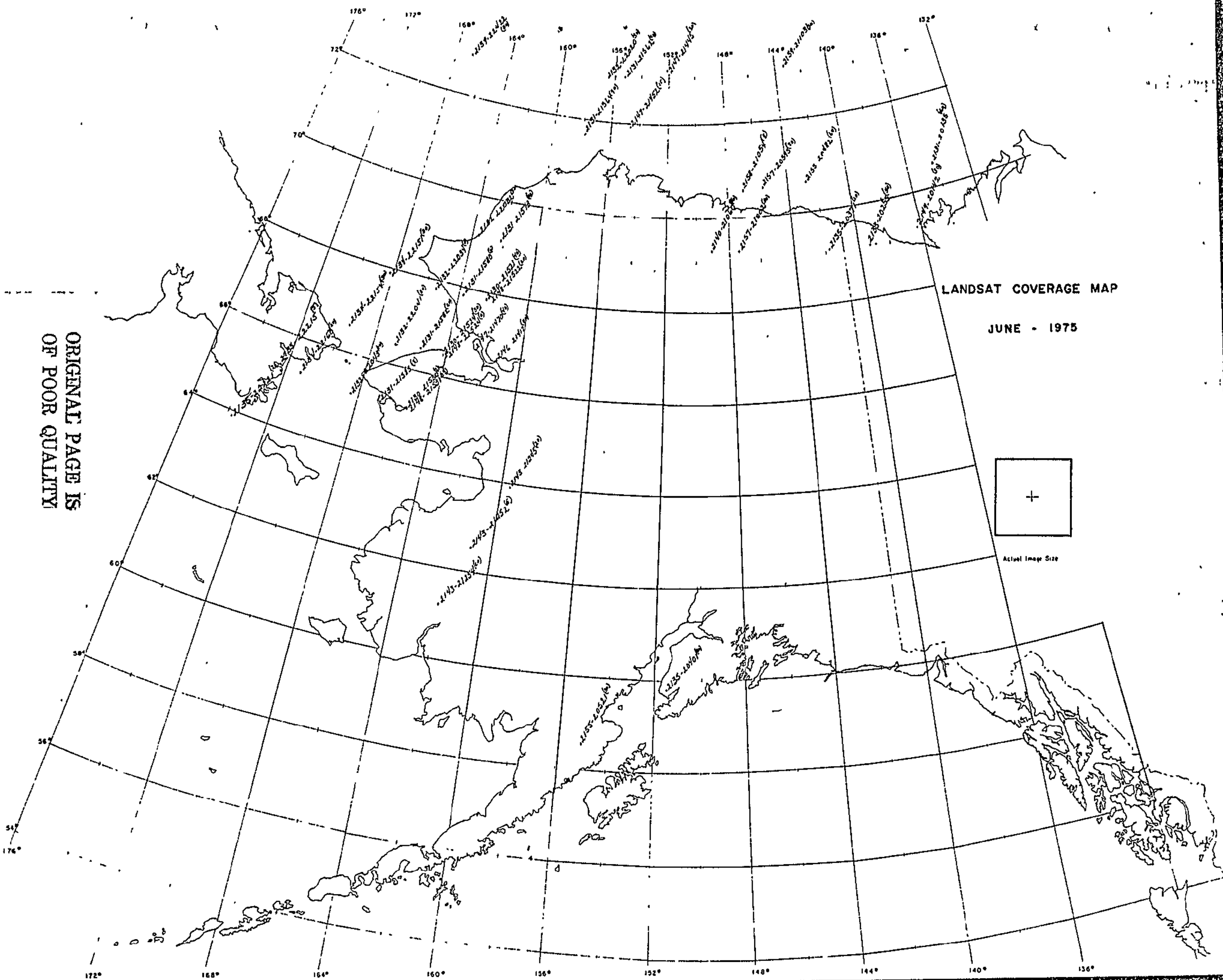

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ERTS SCENES WITH LOW CLOUD COVER
JULY - NOVEMBER 1972

Scene ID No.	Date	Cloud Cover	Lat. Center Pt	Long.	Sun El.	Sun Az.	Map Description	Color = C Digital Tape=
1002-21310	July 25, 1972	15	67.25N	154.43W	41	162	Walker Lake	D + C
1002-21312	July 25, 1972	15	66.06N	156.16W	42	160	Hughes	D
1002-21315	July 25, 1972	10	64.45N	157.42W	43	158	Nulato	C + D
1002-21324	July 25, 1972	15	62.02N	160.09W	45	154	Holy Cross	C
1006-21510	July 29, 1972	5	60.32N	155.26W	37	168	Barrow	
1009-22083	August 1, 1972	5	69.25N	161.30W	37	166	Point Lay	
1009-22090	August 1, 1972	2	68.07N	163.21W	39	164	Point Hope	C
1009-22092	August 1, 1972	0	66.48N	165.00W	40	162	Kotzebue	C
1009-22095	August 1, 1972	0	65.27N	166.30W	41	160	Seward Peninsula	C + D
1009-22101	August 1, 1972	20	64.07N	167.51W	42	158	Nome	
1009-22110	August 1, 1972	10	61.23N	170.14W	44	154	Bering Sea	
1010-20313	August 2, 1972	10	67.56N	139.29W	39	164	Old Crow	
1010-22133	August 2, 1972	10	71.53N	159.04W	35	171	Sea Ice Off Barrow	
1010-22135	August 2, 1972	0	70.37N	161.21W	36	169	Wainwright, Point Lay	C
1010-22142	August 2, 1972	2	69.20N	163.22W	37	166	Point Lay	
1010-22144	August 2, 1972	2	68.02N	165.09W	38	164	Point Hope	C + D
1010-22145	August 2, 1972	5	67.37N	165.26W	39	163	Point Hope	C
1010-22151	August 2, 1972	5	66.42N	166.47W	40	162	Shishmaref	
1010-22153	August 2, 1972	2	65.21N	168.19W	41	160	Teller	
1010-22160	August 2, 1972	0	64.01N	169.39W	42	158	St. Lawrence Island	C
1010-22162	August 2, 1972	10	62.39N	170.53W	43	156	St. Lawrence Island	
1016-21045	August 8, 1972	10	71.20N	142.35W	34	171	Arctic Ocean, sea ice	
1018-21191	August 10, 1972	5	62.40N	156.24W	41	157	Iditarod	C + D
1018-21193	August 10, 1972	0	61.19N	157.32W	42	155	Sleetmute	
1018-21200	August 10, 1972	5	59.57N	158.36W	43	153	Dillingham	C
1019-19423	August 11, 1972	20	59.30N	134.23W	43	153	Atlin	
1019-19430	August 11, 1972	20	58.07N	135.20W	44	151	Juneau	C
1019-21234	August 11, 1972	15	66.24N	153.59W	37	162	Hughes, Bettles	C
1020-19480	August 12, 1972	0	60.32N	135.04W	42	154	Whitehorse	C
1026-20211	August 18, 1972	10	64.28N	140.25W	37	160	Eagle	C
1026-20214	August 18, 1972	10	63.06N	141.40W	38	158	Tanacross	C
1026-20220	August 18, 1972	5	61.45N	142.50W	39	156	McCarthy	C
1027-20255	August 19, 1972	10	68.14N	137.29W	33	166	East of Table Mts	C
1027-20261	August 19, 1972	20	66.55N	139.08W	34	164	East of BlackRiver	C
1027-22074	August 19, 1972	5	72.26N	156.23W	30	174	Sea Ice north of Barrow	
1028-20324	August 20, 1972	20	64.37N	143.08W	36	160	Eagle	
1029-20365	August 21, 1972	20	69.32N	138.38W	32	168	Herschel Island	
1029-20381	August 21, 1972	2	65.33N	143.38W	35	162	Charlie River	D
1029-20383	August 21, 1972	0	64.12N	145.00W	36	160	Big Delta	C + D
1030-20424	August 22, 1972	20	69.27N	139.54W	31	168	Demarcation Point	C
1030-20430	August 22, 1972	10	68.09N	141.45W	32	166	Table Mountains	
1030-20433	August 22, 1972	5	66.50N	143.24W	34	164	Black River	C
1030-20435	August 22, 1972	15	65.29N	144.55W	35	162	Circle	
1030-20442	August 22, 1972	10	64.08N	146.17W	36	160	Fairbanks, Delta	C
1030-22270	August 22, 1972	15	65.52N	170.20W	34	162	Cnukotsk Penn., Siberia	C
1030-22273	August 22, 1972	20	64.31N	171.44W	35	161	Siberia, St. Lawrence Is.	
1033-21020	August 25, 1972	20	62.43N	151.52W	36	159	McKinley	C + D
1033-21022	August 25, 1972	10	61.20N	153.01W	37	157	Lime Hills, Tyonek	
1033-21025	August 25, 1972	10	59.57N	154.04	38	156	Lake Clark, Illiamna	C
1034-21095	August 26, 1972	10	55.46N	158.28W	41	151	Stepovak Bay	C
1037-21231	August 29, 1972	5	68.08N	152.01W	30	167	Chandler Lake, Wiseman	C + D
1037-21234	August 29, 1972	2	66.49N	153.40W	31	165	Hughes, Bettles	C + D
1037-21240	August 29, 1972	5	65.28N	155.09W	32	163	Melozitna	C + D
1037-21243	August 29, 1972	5	64.07N	156.30W	33	161	Nulato, Ruby	
1037-21245	August 29, 1972	5	62.45N	157.44W	35	159	Ophir, Iditarod	
1037-21252	August 29, 1972	20	61.23N	158.53W	36	158	Russian Mission, Sleetmute	C
1038-21295	August 30, 1972	5	65.29N	156.35W	32	163	Kateel River	
1038-21301	August 30, 1972	0	61.08N	157.57W	33	161	Nulato	C + D
1038-21304	August 30, 1972	0	62.46N	159.11W	34	160	Holy Cross, Iditarod	C + D
1038-21310	August 30, 1972	20	61.24N	160.19W	35	158	Russian Mission	D
1039-21371	August 31, 1972	10	60.00N	162.18W	36	157	Kuskokwim Bay	
1039-21374	August 31, 1972	5	58.37N	163.48W	37	155	Kuskokwim Bay	
1043-20161	September 4, 1972	15	62.42N	140.34W	33	160	Nabesna & east	C
1043-20163	September 4, 1972	0	61.19N	141.42W	34	159	McCarthy	C
1044-20201	September 5, 1972	2	68.05N	136.15W	28	167	Aklavik, NWT	
1044-20212	September 5, 1972	2	64.04N	140.11W	31	162	Eagle, Tanacross	C
1044-20215	September 5, 1972	10	62.42N	141.57W	32	161	Tanacross, Nabesna	
1044-22024	September 5, 1972	0	70.40N	158.09W	25	172	Meade River	C
1045-20255	September 6, 1972	0	68.05N	137.39W	27	168	East of Table Mountains	C
1045-22091	September 6, 1972	10	68.05N	163.30W	27	168	Noatak	C
1046-20343	September 7, 1972	5	58.31N	149.04W	35	156	Gulf of Alaska	
1046-203[illegible]	September 7, 1972	10	57.08N	148.58W	36	155	Pacific Ocean	
1046-22143	September 7, 1972	0	69.20N	163.17W	26	170	Point Lay	C

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1046-22145	September 7, 1972	10	68.01N	165.02W	27	168	Point Hope	C
1047-22201	September 8, 1972	20	69.30N	164.20W	25	170	Point Lay	
1049-20505	September 10, 1972	20	61.24N	150.16W	31	160	Anchorage, Cook Inlet	D
1050-20541	September 11, 1972	10	69.28N	142.55W	24	170	Demarcation Point	C - D
1054-21205	September 15, 1972	10	57.12N	160.22W	33	157	Bristol Bay	
1055-21234	September 16, 1972	0	66.45N	153.39W	25	167	Hughes, Bettles	
1056-21310	September 17, 1972	20	61.20N	160.18W	29	161	Russian Mission	
1056-21324	September 17, 1972	40	55.47N	164.04W	33	156	Cold Bay	
1056-21331	September 17, 1972	20	54.24N	164.52W	35	155	Unimak, False Pass	C
1057=19542	September 18, 1972	0	58.31N	137.59W	31	159	Mt. Fairweather	C
1057-21342	September 18, 1972	20	69.31N	153.05W	22	171	Teshekpuk	C
1057-21344	September 18, 1972	0	68.03N	154.55W	23	169	Killik River, Walker Lake	C
1057-21351	September 18, 1972	0	66.44N	156.35W	24	167	Shungnak, Hughes	C
1057-21353	September 18, 1972	0	65.23N	158.04W	25	166	Kateel River, Nulato	C
1057-21360	September 18, 1972	10	64.03N	159.25W	26	164	Norton Bay, Nulato	
1057-21371	September 18, 1972	5	59.55N	162.49W	30	160	Baird Inlet, Kuskokwim Bay	
1058-21403	September 19, 1972	0	68.09N	156.14W	22	169	Howard Pass, Killik River	C
1058-21405	September 19, 1972	0	66.50N	157.52W	23	168	Shungnak	
1058-21412	September 19, 1972	0	65.29N	159.22W	25	166	Candle, Kateel	
1058-21414	September 19, 1972	0	64.08N	160.44W	26	164	Norton Bay, Unalakleet	
1058-21421	September 19, 1972	0	62.46N	161.48W	27	163	St. Michael, Kwiguk	
1058-21423	September 19, 1972	0	61.23N	163.07W	28	162	Marshall	
1059-21445	September 20, 1972	0	72.01N	151.21W	18	176	Arctic Ocean	
1059-21454	September 20, 1972	25	69.28N	155.47W	21	171	Ikpikpuk River	C
1059-21461	September 20, 1972	0	68.10N	157.39W	22	170	Howard Pass	C
1060-20102	September 21, 1972	5	62.44N	139.03W	26	163	Wellesley Lake, Dawson	
1061-20154	September 22, 1972	0	64.04N	139.13W	25	165	Dawson	
1061-20160	September 22, 1972	0	62 43N	140.28W	26	163	E. of Nabesna	
1061-20163	September 22, 1972	0	61.21N	141.36W	27	162	McCarthy & East	C
1061-20165	September 22, 1972	0	59.58N	142.39W	28	161	Icy Bay	C
1061-20172	September 22, 1972	10	58.35N	143.38W	29	159	Pacific Ocean	
1062-20210	September 23, 1972	20	65.26N	139.18W	23	166	Charley River	
1062-20212	September 23, 1972	0	64.05N	140.39W	24	165	Eagle	
1062-20215	September 23, 1972	0	62.43N	141.53W	26	163	Nabesna	
1062-20221	September 23, 1972	0	61.21N	143.01W	27	162	McCarthy	C + D
1063-20262	September 24, 1972	20	66.46N	139.16W	22	168	E. of Black River	
1063-20264	September 24, 1972	0	65.26N	140.46W	23	167	Charley River	C
1063-20271	September 24, 1972	0	64.04N	142.06W	24	165	Eagle - Tanacross	
1063-20273	September 24, 1972	0	62.42N	143.20W	25	164	Nabesna	
1063-20280	September 24, 1972	0	61.20N	144.28W	26	162	Chitina	
1063-20282	September 24, 1972	40	59.58N	145.31W	28	161	Valdez, clouds are over ocean	
1064-20331	September 25, 1972	20	62.42N	144.46W	25	164	Gulkana, Nabesna	
1064-20334	September 25, 1972	0	61.19N	145.55W	26	162	Valdez, Cordova	
1066-20424	September 27, 1972	0	69.29N	139.56W	18	172	Demarcation Point	
1066-20444	September 27, 1972	0	62.47N	147.35W	24	164	Mt. Hayes	C
1066-20451	September 27, 1972	10	61.25N	148.43W	25	163	Anchorage, cloud over city	D-C
1066-20453	September 27, 1972	20	60.02N	149.46W	26	162	Seward, Kenai	D-C
1070-21085	October 1, 1972	0	58.43N	156.24W	26	161	Karluk, Mt. Katmai	C
1072-21173	October 3, 1972	5	68.07N	150.26W	17	171	Philip Smith Mountains, Chandalar	C
1072-21180	October 3, 1972	0	66.48N	152.06W	18	169	Bettles, Tanana	C
1072-21182	October 3, 1972	0	65.28N	153.36W	19	168	Tanana, Ruby	C
1072-21200	October 3, 1972	20	60.01N	158.23W	24	162	Taylor Mts., Dillingham	C
1073-21223	October 4, 1972	0	70.46N	147.55W	14	175	Beechey Point	C
1073-21225	October 4, 1972	0	69.28N	150.01W	15	173	Umiat, Sagavanirktok	D
1073-21232	October 4, 1972	0	68.09N	151.52W	17	171	Chandler Lake, Wiseman	D
1073-21241	October 4, 1972	20	65.29N	155.00W	19	168	Melozitna, Ruby	
1074-21290	October 5, 1972	0	68.08N	153.18W	16	171	Killik River, Chandler Lake	
1074-21293	October 5, 1972	5	66.48N	154.57W	17	170	Hughes	
1074-21295	October 5, 1972	5	65.28N	156.23W	19	168	Kateel River, Nulato	
1074-21302	October 5, 1972	20	64.07N	157 48W	20	167	Ophir, Nulato	
1075-21345	October 6, 1972	10	68.05N	154.46W	16	171	Killik R., Survey Pass	
1075-21351	October 6, 1972	0	66.46N	156.25W	17	170	Shungnak, Kateel River	
1076-21444	October 7, 1972	0	54.28N	167.42W	27	159	Unalaska, Dutch Harbor	
1077-20033	October 8, 1972	0	66 50N	133.21W	16	170	Canada	
1077-20035	October 8, 1972	10	65.30N	134.52W	17	168	Canada	
1077-20042	October 8, 1972	5	64.09N	136.15W	19	167	Mayo Lake	
1077-20053	October 8, 1972	0	60.03N	139.43W	22	163	Yakutat	C
1077-21453	October 8, 1972	5	70.42N	153.43W	13	175	Teshekpuk, Harrison Bay	D
1078-20085	October 9, 1972	0	68.11N	133.10W	15	172	Sitidgie Lake, Canada	
1078-20091	October 9, 1972	0	66.52N	134.50W	16	170	Canada	
1078-20094	October 9, 1972	0	65.32N	136.20W	17	168	Canada	
1078-20100	October 9, 1972	0	64.10N	137 42W	18	167	Dawson	
1078-20103	October 9, 1972	0	62.49N	138.57W	19	166	Dawson	C
1078-20105	October 9, 1972	00	61.27N	140.06W	21	165	Mt. St. Elias	
1078-20112	October 9, 1972	5	60.05N	141.10W	22	163	Icy Bay, Yakutat	C
1081-20263	October 12, 1972	5	66.48N	139.13W	15	170	E. of Black River	
1081-20270	October 12, 1972	0	65.28N	140.43W	16	169	E. of Charlie River	

1081-20272	October 12, 1972	0	64.06N	142.04W	17	167	Eagle	C
1081-20275	October 12, 1972	0	62.45N	143.19W	18	166	Nabesna	C
1081-20281	October 12, 1972	0	61.22N	144.28W	20	165	Cordova, McCarthy	C-D
1081-20284	October 12, 1972	0	60.00N	145.31W	21	164	Cordova	C
1082-20324	October 13, 1972	0	65.28N	142.06W	16	169	Eagle, Charley River	C
1084-19042	October 15, 1972	0	54.22N	127.36W	23	160	Smithers - Canada	
1085-19094	October 16, 1972	0	55.47N	128.15W	23	161	E. of Ketchikan	
1085-19100	October 16, 1972	0	54.23N	129.03W	24	160	Kitimat, S.E.	
1086-19152	October 17, 1972	0	55.45N	129.41W	23	161	Woodcock, S.E.	
1086-20543	October 17, 1972	5	69.20N	143.00W	11	174	Demarcation Point	C
1086-20545	October 17, 1972	5	68.01N	144.50W	12	172	Christian, Table Mountains	D
1087-20595	October 18, 1972	0	70.38N	142.23W	9	176	Barter Island	
1087-21004	October 18, 1972	0	68.03N	146.17W	11	172	Philip Smith Mountains	D
1088-21062	October 19, 1972	0	68.01N	147.47W	11	172	Philip Smith Mountains	D + C
1088-21071	October 19, 1972	20	65.22N	150.54W	14	169	Tanana, Livengood	
1088-21074	October 19, 1972	20	64.00N	152.15W	15	168	Kantishna River	
1091-19414	October 22, 1972	0	64.00N	138.42W	14	168	Dawson	
1094-19581	October 25, 1972	5	66.37N	132.14W	10	171	Canada	
1094-19583	October 25, 1972	15	65.17N	133.43W	12	169	Canada	
1094-19590	October 25, 1972	0	63.56N	135.05W	13	168	Mayo Lake, Canada	
1094-19595	October 25, 1972	0	61.12N	137.27W	15	166	Kluane Lake, Canada	
1094-20001	October 25, 1972	0	59.50N	138.29W	16	165	Mt. Fairweather	
1096-20112	October 27, 1972	0	61.14N	140.18W	15	166	McCarthy, Mt. St. Elias	
1096=20114	October 27, 1972	0	59.51N	141.20W	16	165	Yakutat	
1100-20315	October 31, 1972	50	69.14N	137.31W	06	174	Herschel Island, land clear	
1100-20324	October 31, 1972	0	66.36N	140.58W	08	171	Black River	
1100-20330	October 31, 1972	5	65.16N	142.26W	10	170	Charley River	
1100-20342	October 31, 1972	0	61.12N	146.07W	13	166	Valdez	
1101-20403	November 1, 1972	0	59.48N	148.31W	14	165	Blying Sound	
1102-20434	November 2, 1972	20	67.51N	142.13W	07	173	Coleen	D
1102-20441	November 2, 1972	0	66.31N	143.50W	08	171	Black River, Charlie River	D-C
1102-20443	November 2, 1972	20	65.11N	145.19W	09	170	Circle	
1102-28450	November 2, 1972	0	63.50N	146.39W	10	168	Mt. Hayes	C
1102-20452	November 2, 1972	0	62.29N	147.52W	11	167	Talkeetna Mtns	
1102-20455	November 2, 1972	0	61.06N	148.59W	13	166	Anchorage, Cook Inlet	C
1102-20461	November 2, 1972	0	59.44N	150.01W	14	165	Seldovia	C
1102-20464	November 2, 1972	0	58.21N	150.58W	15	164	Pacific Ocean	

1102-20470	November 2, 1972	0	56.59N	151.52W	16	163	Kaguyak	
1103-20493	November 3, 1972	0	67.50N	143.39W	06	173	Coleen, Black River	D
1103-20495	November 3, 1972	0	66.31N	145.17W	07	171	Ft. Yukon, Circle	C + D
1103-20502	November 3, 1972	0	65.11N	146.45W	09	170	Fairbanks	D
1103-20504	November 3, 1972	0	63.50N	148.05W	10	168	Healy, Talkeetna Mts.	C
1103-20511	November 3, 1972	0	62.28N	149.19W	11	167	Talkeetna Mts., Anchorage	D + C
1103-20513	November 3, 1972	0	61.06N	150.27W	12	166	Anchorage, Cook Inlet	D
1103-20520	November 3, 1972	0	59.44N	151.30W	14	165	Kenai Peninsula	D
1103-20522	November 3, 1972	0	58.21N	152.28W	15	164	Kodiak, Afognak	
1104-20554	November 4, 1972	0	66.30N	146.45W	07	171	Fort Yukon	D-C
1104-20560	November 4, 1972	0	65.10N	148.12W	08	170	Fairbanks	D
1104-20563	November 4, 1972	0	63.49N	149.31W	10	169	McKinley	C
1104-20565	November 4, 1972	0	62.28N	150.44W	11	167	Talkeetna	C + D
1104-20572	November 4, 1972	0	61.06N	151.15W	12	166	Cook Inlet; Tyonek	C + D
1104-21574	November 4, 1972	0	59.44N	152.53W	13	165	Iliamna, Seldovia	C
1105-21010	November 5, 1972	0	67.50N	146.32W	06	173	Christian, Fort Yukon	C + D
1105-21012	November 5, 1972	0	66.30N	148.09W	07	171	Beaver	C
1105-21015	November 5, 1972	0	65.10N	149.38W	08	170	Minto	C
1105-21021	November 5, 1972	0	63.50N	150.50W	09	169	Mt. McKinley	C
1105-21033	November 5, 1972	20	59.44N	154.18W	13	165	Iliamna, Mt. Katmai	C
1105-21035	November 5, 1972	20	58.21N	155.16W	14	164	Karluk, Mt. Katmai	C

Scene I.D.	Date	Cloud Cover	Lat. Center Pt.	Long.	Sun El.	Sun Az.	Map Description	Color = C Digital Tape=D
1198-19373	February 6, 1973	0	60.06N	132.38W	12	158	Atlin	
1198-19380	February 6, 1973	0	58.43N	133.37W	13	157	Juneau	C
1198-19382	February 6, 1973	5	57.19N	134.32W	14	156	Sitka - Sumdum	
1198-19385	February 6, 1973	0	55.56N	135.23W	15	155	Port Alexander	C
1199-19432	February 7, 1973	0	60.03N	134.07W	12	158	Atlin	
1199-19434	February 7, 1973	0	58.40N	135.06W	13	157	Juneau	C
1199-19441	February 7, 1973	0	57.17N	136.01W	15	156	Sitka	
1200-19490	February 8, 1973	0	60.00N	135.37W	13	158	Skagway	C
1200-19493	February 8, 1973	2	58.37N	136.35W	14	157	Mt. Fairweather	C
1204-20114	February 12, 1973	0	61.23N	140.18W	13	159	East of McCarthy	
1204-20120	February 12, 1973	2	60.00N	141.21W	14	158	Bering Glacier	
1205-21590	February 13, 1973	0	66.51N	162.17W	09	164	Kotzebue	
1205-21592	February 13, 1973	0	65.31N	163.46W	10	162	Bendleben	
1205-21595	February 13, 1973	0	64.10N	165.08W	11	161	Nome - Soloman	
1205-22001	February 13, 1973	5	62.49N	166.23W	12	160	Black	
1205-22004	February 13, 1973	5	61.27N	167.32W	13	159	Hooper Bay	
1211-20501	February 19, 1973	0	66.50N	145.05W	11	164	Fort Yukon	C
1211-20504	February 19, 1973	50	65.29N	146.35W	12	162	Livengood-Circle, Top half of scene clear	
1216-21181	February 24, 1973	0	69.27N	148.47W	10	167	Sagavanirktok - Philip Smith Mtns	
1216-21183	February 24, 1973	0	68.08N	150.37W	11	165	Chandler Lake, Philip Smith Mtns.	
1216-21190	February 24, 1973	0	66.49N	152.11W	13	164	Bettles	
1216-21192	February 24, 1973	0	65.29N	153.46W	14	162	Melozitna - Tanana	
1216-21195	February 24, 1973	0	64.08N	155.07W	15	161	Ruby	
1216-21201	February 24, 1973	0	62.47N	156.21W	16	159	Iditarod, McGrath	
1216-21204	February 24, 1973	0	61.25N	157.30W	17	158	Sleetmute	
1216-21210	February 24, 1973	0	60.03N	158.33W	18	157	Taylor Mtns	
1217-21235	February 25, 1973	0	59.26N	150.13W	11	167	Umiat, Sagavanirktok	
1217-21242	February 25, 1973	0	68.08N	152.04W	12	165	Chandler Lake	
1217-21244	February 25, 1973	0	66.48N	153.44W	13	164	Hughes, Bettles	
1217-21251	February 25, 1973	0	65.28N	155.14W	14	162	Melozitna	
1217-21253	February 25, 1973	0	64.07N	156.36W	15	161	Nulato - Ophir	
1217-21260	February 25, 1973	0	62.45N	157.58W	16	159	Iditarod	
1217-21262	February 25, 1973	0	61.24N	158.58W	17	158	Russian Mission - Sleetmute	
1217-21265	February 25, 1973	0	60.01N	160.02W	19	157	Bethel - Taylor Mts.	
1217-21271	February 25, 1973	5	58.39N	161.01W	20	156	Hagemeister Island	
1218-21300	February 26, 1973	0	68.07N	153.33W	12	165	Chandler Lake	
1218-21303	February 26, 1973	15	66.47N	155.13W	13	163	Hughes	
1218-21305	February 26, 1973	0	65.28N	156.42W	14	162	Ka teel River, Melozitna	
1218-21312	February 26, 1973	0	64.07N	158.03W	16	161	Nulato	
1218-21314	February 26, 1973	0	62.45N	159.17W	17	159	Holy Cross, Iditarod	
1218-21321	February 26, 1973	0	61.23N	160.25W	19	158	Russian Mission	
1219-21343	February 27, 1973	5	71.58N	148.47W	09	171	N. of Beechey Point	
1219-21361	February 27, 1973	0	66.47N	156.39W	14	163	Shungnak - Hughes	
1219-21364	February 27, 1973	0	65.26N	158.08W	15	162	Kateel River	
1219-21370	February 27, 1973	0	64.05N	159.29W	16	161	Norton Bay, Nulato	
1219-21373	February 27, 1973	0	62.44N	160.44W	17	159	Holy Cross	
1219-21375	February 27, 1973	0	61.22N	161.52W	18	158	Russian Mission	
1219-21382	February 27, 1973	0	59.59N	162.55W	19	157	Baird Inlet	
1219-21384	February 27, 1973	0	58.36N	163.54W	20	156	Bristol Bay - mostly ice	
1219-21391	February 27, 1973	0	57.14N	164.50W	21	155	Bristol Bay, shows edge of ice	
1220-21413	February 28, 1973	20	68.05N	156.27W	13	165	Howard Pass, Ambler River	
1220-21420	February 28, 1973	0	66.46N	158.05W	14	163	Shungnak	
1220-21422	February 28, 1973	0	65.26N	159.34W	15	162	Candle, Kateel River	
1220-21425	February 28, 1973	0	64.05N	160.55W	16	161	Norton Bay	
1220-21431	February 28, 1973	20	62.44N	162.10W	18	159	Kwiguk	
1220-21434	February 28, 1973	15	61.22N	163.18W	19	158	Marshall	
1220-21440	February 28, 1973	5	59.59N	164.21W	20	157	Baird Inlet, Nunivak Island	
1220-21443	February 28, 1973	25	58.36N	165.20W	21	156	Bristol Bay, sea ice	
1220-21445	February 28, 1973	05	57.13N	166.15W	22	155	Bristol Bay, edge of ice	
1226-20322	March 6, 1973	0	69.29N	137.30W	14	167	Herschel Island.	
1226-20324	March 6, 1973	0	68.10N	139.10W	15	165	East of Table Mountains	
1226-20331	March 6, 1973	5	66.50N	140.48W	16	164	East of Black River	
1226-20340	March 6, 1973	5	64.09N	143.39W	19	161	Eagle	
1226-22153	March 6, 1973	0	69.27N	163.11W	14	167	Chukchi Sea off Point Lay	
1226-22160	March 6, 1973	0	68 09N	165.00W	15	165	Point Hope	
1226-22162	March 6, 1973	0	66.50N	166.39W	16	164	Shishmaref	
1226-22165	March 6, 1973	0	65.30N	168 08W	18	162	Seward Peninsula	
1226-22171	March 6, 1973	0	64.09N	169.30W	19	161	St Lawrence Island	
1226-22174	March 6, 1973	0	62 48N	170 45W	20	159	St. Lawrence Island	
1227-20394	March 7, 1973	10	64.07N	145.10W	19	161	Big Delta, very bottom of image cloudy	D
1227-22203	March 7, 1973	0	72.00N	160.17W	12	172	N. of Wainwright	
1227-22212	March 7, 1973	0	69.27N	164.40W	15	167	Point Lay	
1227-22214	March 7, 1973	0	68.08N	166.31W	16	165	Point Hope	
1227-22221	March 7, 1973	0	66.49N	168.10W	17	164	Bering Straits, Chukchi Sea	
1227-22223	March 7, 1973	0	65.29N	169.33W	18	162	Bering Straits	
1227-22230	March 7, 1973	0	64.08N	171.00W	19	161	St. Lawrence Island	
1227-22232	March 7, 1973	10	62.46N	172.14W	20	159	Bering Sea - Ice	

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1228-20435	March 8, 1973	0	69.28N	140.17W	15	167	Herschel Island	
1228-22270	March 8, 1973	0	69.27N	166.02W	15	167	Point Hope	
1228-22273	March 8, 1973	0	68.08N	167.53W	16	165	Point Hope	
1228-22275	March 8, 1973	0	66.49N	169.32W	17	164	Siberia, Chukchi Sea	
1231-21012	March 11, 1973	10	68.07N	146.15W	17	165	Arctic	
1234-21175	March 14, 1973	0	70.38N	146.59W	16	169	Flaxman Island	
1234-21181	March 14, 1973	15	69.21N	149.01W	17	167	Sagavanirktok	
1234-21204	March 14, 1973	2	61.19N	157.39W	24	158	Sleetmute	
1234-21211	March 14, 1973	0	59.57N	158.42W	25	157	Dillingham	
1234-21213	March 14, 1973	10	58.34N	159.40W	26	155	Nushagak Bay	
1235-21233	March 15, 1973	0	70.39N	148.22W	17	169	Beechey Point	
1235-21240	March 15, 1973	0	69.22N	150.25W	18	167	Umiat, Sagavanirktok	
1235-21242	March 15, 1973	2	68.04N	152.14W	19	165	Chandler Lake	
1235-21263	March 15, 1973	20	61.21N	129.04W	25	158	Russian Mission, Sleetmute	
1235-21265	March 15, 1973	3	59.58N	160.06W	26	157	Goodnews	
1235-21272	March 15, 1973	5	58.35N	161.04W	27	155	Hagemeister Island	
1235-21274	March 15, 1973	10	57.12N	161.58W	28	154	Bristol Bay	
1236-21292	March 16, 1973	0	70.39N	149.53W	17	169	Beechey Point	
1236-21294	March 16, 1973	0	69.21N	151.55W	18	167	Umiat	D
1236-21301	March 16, 1973	0	68.03N	153.44W	19	165	Killik River, Chandler Lake	D
1236-21303	March 16, 1973	0	66.44N	155.23W	20	164	Hughes	
1236-21310	March 16, 1973	0	65.23N	156.52W	22	162	Kateel River	
1236-21312	March 16, 1973	0	64.02N	158.12W	23	161	Nulato	
1236-21324	March 16, 1973	0	59.56N	161.36W	26	157	Goodnews	
1236-21330	March 16, 1973	0	58.33N	162.34W	27	155	Hagemeister Island	
1236-21333	March 16, 1973	0	57.11N	163.29W	28	154	Bristol Bay	
1237-19551	March 17, 1973	5	59.59N	137.13W	26	157	Skagway	
1237-19553	March 17, 1973	20	58.36N	138.12W	27	155	Mt. Fairweather	
1237-21344	March 17, 1973	0	71.56N	148.58W	16	172	N. of Beechey Point	
1237-21350	March 17, 1973	0	70.39N	151.15W	17	170	Harrison Bay, Beechey Point'	
1237-21353	March 17, 1973	0	69.22N	153.17W	19	167	Ikpikpuk River, Umiat	
1237-21355	March 17, 1973	0	68.04N	155.05W	20	166	Killik River, Survey Pass	
1237-21362	March 17, 1973	5	66.45N	156.43W	21	164	Shungnak	
1237-21373	March 17, 1973	0	62.42N	160.47W	24	159	Holy Cross	
1237-21385	March 17, 1973	0	58.36N	163.57W	27	155	Bristol Bay--ice	
1237-21391	March 17, 1973	0	57.13N	164.51W	29	154	Bristol Bay, edge of ice	
1238-21402	March 18, 1973	0	71.54N	150.26W	17	172	Arctic Ocean, n. of Harrison Bay	
1238-21405	March 18, 1973	0	70.38N	152.45W	18	170	Harrison Bay	
1238-21411	March 18, 1973	0	69.21N	154.48W	19	167	Ikpikpuk River	
1238-21414	March 18, 1973	0	68.02N	156.37W	20	166	Howard Pass, Killik River	
1238-21420	March 18, 1973	0	66.44N	158.18W	21	164	Shungnak	
1238-21423	March 18, 1973	0	65.24N	159.47W	22	162	Candle, Kateel	
1238-21425	March 18, 1973	0	64.02N	161.08W	24	161	Norton Bay	
1238-21432	March 18, 1973	0	62.40N	162.21W	25	159	Kwiguk, Holy Cross	
1238-21434	March 18, 1973	0	61.18N	163.28W	26	158	Marshall	
1238-21441	March 18, 1973	0	59.57N	164.29W	27	156	Nunivak Island	
1238-21443	March 18, 1973	0	58.34N	165.28W	28	155	Bristol Bay	
1239-20061	March 19, 1973	0	61.21N	129.03W	26	158	East of McCarthy	
1239-21461	March 19, 1973	0	71.55N	151.53W	17	172	N. of Teshekpuk	
1239-21463	March 19, 1973	0	70.40N	154.11W	18	170	Teshekpuk	
1239-21470	March 19, 1973	0	69.23N	156.13W	19	168	Lookout Ridge, Ikpikpuk River	
1239-21472	March 19, 1973	0	68.05N	158.03W	21	166	Howard Pass, Ambler River	
1239-21475	March 19, 1973	0	66.45N	159.41W	22	164	Selawik, Shungnak	
1239-21481	March 19, 1973	0	65.25N	161.09W	23	162	Candle	
1239-21484	March 19, 1973	0	64.04N	162.30W	24	161	Solomon, Norton Bay	
1239-21490	March 19, 1973	0	62.43N	163.44W	25	159	Kwiguk	
1239-21493	March 19, 1973	0	61.21N	164.51W	26	158	Marshall	
1239-21495	March 19, 1973	0	59.59N	165.53W	27	157	Cape Mendenhall	
1239-21502	March 19, 1973	0	58.36N	166.51W	28	155	Bristol Bay	
1240-20115	March 20, 1973	0	61.23N	140.27W	26	159	E. of McCarthy	
1240-21515	March 20, 1973	0	71.56N	153.12W	18	172	N. of Teshekpuk	
1240-21531	March 20, 1973	0	68.06N	159.25W	21	166	Misheguk Mtns, Howard Pass	
1240-21533	March 20, 1973	0	66.47N	161.04W	22	164	Selawik	
1240-21540	March 20, 1973	0	65.26N	162.33W	23	162	Bendleben, Candle	
1240-21542	March 20, 1973	0	64.06N	163.53W	24	161	Solomon	
1240-21545	March 20, 1973	0	62.45N	165.07W	25	159	Black, Kwiguk	
1240-21551	March 20, 1973	0	61.22N	166.15W	27	158	dHooper Bay	
1240-21554	March 20, 1973	0	60.00N	167.18W	28	157	Nunivak Island	
1241-20165	March 21, 1973	1	61.06N	139.29W	25	161	E. of Eagle	
1241-20171	March 21, 1973	0	62.45N	140.43W	-26	159	E. of Nabesna	
1241-21573	March 21, 1973	0	71.58N	154.38W	18	172	Barrow	
1241-21580	March 21, 1973	0	70.12N	156.57W	19	170	Meade River	
1241-21582	March 21, 1973	0	69.25N	159.00W	20	168	Lookout Ridge, Utukok River	

1241-21585	March 21, 1973	0	68.07N	160.49W	21	166	Misheguk Mtn
1241-21591	March 21, 1973	0	66.48N	162.28W	22	164	Kotzebue, Selawik
1241-21594	March 21, 1973	0	65.28N	163.51W	24	162	Bendleben
1241-22000	March 21, 1973	0	64.07N	165.18W	25	161	Norton Sound, Nome
1241-22003	March 21, 1973	0	62.46N	166.31W	26	159	Black, Bering Sea
1241-22005	March 21, 1973	0	61.24N	167.39W	27	158	Bering Sea, Hooper Bay
1241-22012	March 21, 1973	10	60.02N	168.43W	28	157	Bering Sea, Nunivak Island
1242-20221	March 22, 1973	0	65.25N	139.38W	24	162	E. of Charley River
1242-22032	March 22, 1973	0	71.55N	156.08W	18	172	Barrow
1242-22034	March 22, 1973	0	70.39N	158.26W	19	170	Meade River
1242-22041	March 22, 1973	0	69.22N	160.28W	21	168	Utukok River
1242-22043	March 22, 1973	20	68.04N	162.17W	22	166	Delong Mtns, Misheguk
1243-22090	March 23, 1973	0	71.56N	157.35W	19	172	N. of Barrow
1243-22093	March 23, 1973	0	70.40N	159.52W	20	170	Wainwright, Meade River
1243-22095	March 23, 1973	0	69.24N	161.55W	21	168	Point Lay
1243-22113	March 23, 1973	5	64.66N	168.16W	26	161	Nome
1243-22120	March 23, 1973	10	62.44N	169.30W	27	159	St. Lawrence Island
1243-22125	March 23, 1973	0	60.01N	171.41W	29	157	Bering Sea, ice
1243-22131	March 23, 1973	10	58.38N	172.40W	30	155	Bering Sea, ice
1247-20491	March 27, 1973	5	70.41N	139.47W	21	170	E. of Barter Island
1247-20493	March 27, 1973	0	69.23N	141.50W	23	168	Demarcation Point
1247-20505	March 27, 1973	15	65.26N	146.49W	26	162	Circle
1247-20511	March 27, 1973	25	64.05N	148.09W	27	161	Fairbanks D+C
1251-21130	March 31, 1973	0	68.09N	149.21W	25	166	Philip Smith Mountains
1251-21132	March 31, 1973	10	66.50N	151.00W	26	164	Bettles
1251-21135	March 31, 1973	0	65.30N	152.30W	28	163	Tanana
1251-21141	March 31, 1973	0	64.10N	153.52W	29	161	Ruby, Kantishna
1252-21175	April 1, 1973	0	70.43N	146.57W	23	170	Flaxman Island
1252-21182	April 1, 1973	0	69.26N	149.01W	25	168	Sagavanirktok
1252-21184	April 1, 1973	20	68.08N	150.51W	26	166	Chandler Lake, Philip Smith Mtns
1252-21191	April 1, 1973	2	66.49N	152.29W	27	164	Bettles
1252-21193	April 1, 1973	2	65.28N	153.59W	28	163	Melozitna, Tanana
1253-21233	April 2, 1973	20	70.43N	148.19W	24	171	Beechey Point
1253-21240	April 2, 1973	20	69.27N	150.21W	25	168	Umiat, Sagavanirktok
1253-21242	April 2, 1973	0	68.09N	152.11W	26	166	Chandler Lake
1253-21245	April 2, 1973	25	66.49N	153.51W	27	164	Hughes, Bettles
1253-21265	April 2, 1973	0	60.04N	160.07W	33	157	Bethel, Goodnews
1253-21272	April 2, 1973	5	58.41N	161.06W	34	155	Hagemeister Island
1253-21274	April 2, 1973	0	57.18N	162.00W	35	154	Bristol Bay
1253-21281	April 2, 1973	10	55.54N	162.52W	36	152	Cold Bay, Port Moller
1253-21283	April 2, 1973	15	54.30N	163.40W	37	151	False Pass
1254-21303	April 3, 1973	0	66.48N	155.25W	28	164	Hughes
1254-21310	April 3, 1973	0	65.28N	156.54W	29	163	Kateel River,-Melozitna
1254-21312	April 3, 1973	0	64.07N	158.15W	30	161	Nulato
1254-21315	April 3, 1973	0	62.46N	159.29W	31	159	Holy Cross, Iditarod
1254-21321	April 3, 1973	0	61.24N	160.36W	32	158	Russian Mission
1254-21324	April 3, 1973	0	60.02N	161.39W	33	156	Baird Inlet, Bethel
1255-19551	April 4, 1973	5	60.01N	137.13W	33	156	N. of Skagway
1255-21355	April 4, 1973	0	68.07N	155.12W	27	166	Killik River
1255-21364	April 4, 1973	0	65.28N	158.18W	29	163	Kateel River
1255-21371	April 4, 1973	0	64.08N	159.39W	30	161	Norton Bay, Nulato
1256-21402	April 5, 1973	0	72.00N	150.23W	24	173	N. of Harrison Bay
1256-21405	April 5, 1973	0	70.44N	152.44W	25	171	Harrison Bay
1256-21411	April 5, 1973	0	69.27N	154.48W	26	168	Ikpikpuk River
1256-21414	April 5, 1973	0	68.09N	156.37W	27	166	Howard Pass
1257-21461	April 6, 1973	0	72.01N	151.50W	24	173	N. of Harrison Bay
1258-21515	April 7, 1973	0	72.01N	153.14W	25	173	N. of Teshekpuk
1258-21540	April 7, 1973	10	65.30N	162.35W	30	163	Bendleben, Candle
1258-21542	April 7, 1973	0	64.09N	163.56W	31	161	Solomon
1258-21545	April 7, 1973	0	62.47N	164.59W	32	160	Black, Kwiguk
1258-21551	April 7, 1973	0	61.26N	166.17W	34	158	Hooper Bay
1258-21563	April 7, 1973	60	57.17N	169.14W	37	154	Top cloudy but Pribilof Islands seem clear
1258-21565	April 7, 1973	20	55.54N	170.05W	38	152	Pribilof Islands
1259-21580	April 8, 1973	5	70.45N	156.57W	26	171	Barrow
1259-21582	April 8, 1973	10	69.28N	159.01W	27	169	Utukok River - Lookout Ridge
1259-21585	April 8, 1973	0	68.09N	160.51W	28	167	Misheguk Mtn.
1259-21591	April 8, 1973	2	66.50N	162.30W	29	165	Kotzebue - Selawik
1259-21594	April 8, 1973	0	65.30N	163.59W	31	163	Bendleben
1259-22000	April 8, 1973	5	64.09N	165.20W	32	161	Nome - Soloman
1259-22003	April 8, 1973	20	62.48N	166.35W	33	160	Black
1260-22032	April 9, 1973	0	72.01N	156.04W	25	174	Barrow
1261-20284	April 10, 1973	0	62.48N	143.38W	34	160	Nabesna
1261-22090	April 10, 1973	0	72.01N	157.30W	26	174	N. Of Barrow
1261-22093	April 10, 1973	10	70.45N	159.45W	27	171	Wainwright, Meade River
1261-22102	April 10, 1973	15	68.09N	163.43W	29	167	Delong Mountains

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1261-22120	April 10, 1973	10	62.48N	169.25W	34	160	Bering Sea - Ice	
1262-20331	April 11, 1973	0	66.51N	140.59W	31	165	Black River	
1262-20334	April 11, 1973	0	65.31N	142 28W	32	163	Charley River	
1262-20340	April 11, 1973	10	64.10N	143.50W	33	161	Eagle	
1262-22145	April 11, 1973	5	72.02N	159.00W	26	174	N. of Wainwright	
1262-22151	April 11, 1973	5	70.46N	161.19W	27	171	Wainwright	
1262-22154	April 11, 1973	10	69.29N	163.21W	28	169	Point Lay	
1262-22160	April 11, 1973	3	68.11N	165 12W	29	167	DeLong Mountains	
1262-22163	April 11, 1973	5	66.52N	166.51W	31	165	Shishmaref	
1263-20383	April 12, 1973	0	68.10N	140.51W	30	167	Table Mtn	D
1263-20385	April 12, 1973	0	66.50N	142.29W	31	165	Black River	D
1263-20392	April 12, 1973	0	65.30N	143.58W	32	163	Charley River	
1263-20394	April 12, 1973	5	64.09N	145.19W	33	161	Big Delta	D
1263-22203	April 12, 1973	0	72.02N	160.23W	26	174	N. of Wainwright	
1263-22210	April 12, 1973	0	70.46N	162.43W	28	171	Wainwright	
1263-22212	April 12, 1973	0	69.29N	164.46W	29	169	Point Lay	
1264-19051	April 13, 1973	0	54.31N	129.49W	41	151	Canada, SE of Prince Rupert	
1264-20435	April 13, 1973	20	69.28N	140.21W	29	169	Herschel Is.	
1264-20441	April 13, 1973	10	68.11N	142.11S	30	167	Table Mountains	
1264-20444	April 13, 1973	0	66.51N	143.50W	31	165	Black River	
1265-20500	April 14, 1973	0	68.13N	143.38W	30	167	Table Mrs.	
1266-20554	April 15, 1973	10	68.13N	145.03W	31	167	Arctic	
1266-20561	April 15, 1973	20	66.54N	146.42W	32	165	Fort Yukon	
1266-20572	April 16, 1973	0	62.52N	150.47W	35	160	Talkeetna Mtn	D-C
1267-21012	April 16, 1973	5	68.13N	146.27W	31	167	Arctic	D
1267-21051	April 16, 1973	10	55.57N	157.10W	41	152	Sutwik Island	
1268-21064	April 17, 1973	5	69.29N	146.10W	30	169	Mt. Michelson	
1268-21071	April 17, 1973	0	68.11N	147.59W	32	167	Philip Smith Mtns	
1268-21073	April 17, 1973	20	66.51N	149.37W	33	165	Beaver	
1269-21123	April 18, 1973	10	69.29N	147.34W	31	169	Sagavanirktok - Mt. Michelson	
1269-21125	April 18, 1973	0	68.10N	149.24W	32	167	Philip Smith Mtns.	
1269-21132	April 18, 1973	20	66.51N	151.03W	33	165	Bettles	
1269-21155	April 18, 1973	20	58.42N	158.16W	40	155	Nushagak Bay	
1270-21181	April 19, 1973	5	69.29N	149.00W	31	169	Sagavanirktok	
1271-21240	April 20, 1973	10	69.30N	150.25W	31	169	Umiat - Sagavanirktok	
1271-21242	April 20, 1973	0	68.12N	152.15W	33	167	Chandler Lake	
1271-21245	April 20, 1973	0	66.52N	153.54W	34	165	Hughes - Bettles	
1271-21251	April 20, 1973	0	65.32N	155.23W	35	163	Melozitna	
1271-21254	April 20, 1973	0	64.11N	156.44W	36	161	Nulato, Ruby	
1271-21263	April 20, 1973	5	61.28N	159.07W	38	158	Russian Mission - Sleetmute	
1271-21272	April 20, 1973	15	58.42N	161.09W	40	155	Hagemeister Island	
1272-21294	April 21, 1973	15	69.33N	151.47W	32	169	Umiat	
1272-21300	April 21, 1973	5	68.14N	153.38W	33	167	Killik River, Chandler Lake	
1272-21303	April 21, 1973	0	66.55N	155.18W	34	165	Hughes	
1272-21305	April 21, 1973	0	65.35N	156.47W	35	163	Kateel River, Melozitna	
1272-21312	April 21, 1973	0	64.14N	158.09W	36	161	Nulato	
1272-21314	April 21, 1973	0	62.53N	159.24W	37	160	Holy Cross, Iditarod	
1272-21321	April 21, 1973	0	61.31N	160.33W	39	158	Russian Mission	
1272-21323	April 21, 1973	0	60.08N	161.37W	40	156	Bethel	
1272-21330	April 21, 1973	0	58.46N	162.36W	41	155	Kuskokwim Bay - Hagemeister Is.	
1272-21332	April 21, 1973	0	57.22N	163.31W	42	153	Bristol Bay & Ice	
1273-21361	April 22, 1973	10	66.55N	156.44W	34	165	Shungnak - Hughes	
1273=21364	April 22, 1973	0	65.35N	158.14W	36	163	Kateel River	
1273-21370	April 22, 1973	0	64 15N	159.35W	37	161	Norton Bay, Nulato	
1274-20002	April 23, 1973	0	61.31N	137.34W	39	158	N. of Skagway	
1274-20005	April 23, 1973	15	60 09N	138.37W	40	156	Yakutat	
1274-21402	April 23, 1973	5	72.06N	150.16W	30	174	N. of Harrison Bay	
1274-21420	April 23, 1973	10	66.56N	158.10W	35	165	Shungnak	
1274-21422	April 23, 1973	0	65.36N	159.40W	36	163	Candle, Kateel R.	
1274-21425	April 23, 1973	0	64.15N	161.02W	37	161	Norton Bay	
1275-20061	April 24, 1973	[illegible]	61.31N	139.01W	40	158	North of Mt. St. Elias	
1275-20063	April 24, 1973	20	60.09N	140.04W	41	156	Mt. St. Elias	
1275-21483	April 24, 1973	0	64.14N	162.28W	37	161	Norton Bay	
1276-21542	April 25, 1973	0	61.14N	163 53W	38	161	Soloman	
1276-21544	April 25, 1973	0	62.53N	165.08W	39	160	Black - Kwiguk	
1276-21551	April 25, 1973	0	61.30N	166.16W	40	158	Hooper Bay	
1276-21553	April 25, 1973	10	60.08N	167 20W	41	156	Nunivak Island	
1277-21584	April 26, 1973	0	68.18N	160.48W	35	167	Misheguk Mtns	
1277-22000	April 26, 1973	0	64.18N	165.19W	38	161	Nome, Soloman	
1277-22002	April 26, 1973	0	62.56N	166.34W	39	160	Black	
1277-22005	April 26, 1973	10	61.34N	167.42W	40	158	Hooper Bay	
1277-22011	April 26, 1973	0	60.11N	168.45W	41	156	Bering Sea	
1279-20265	April 28, 1973	5	68.19N	137 45W	35	167	East of Table Mts	
1279-20272	April 28, 1973	15	67.00N	139.26W	36	165	East of Coleen	
1279-20274	April 28, 1973	15	65.40N	140.56W	37	163	Charley River	
1279-20281	April 28, 1973	0	64.19N	142.18W	39	161	Eagle	

1279-22090	April 28, 1973	0	72.11N	157.18W	32	175	Barrow	
1279-22092	April 28, 1973	5	70.55N	159.39W	33	172	Wainwright, Meade River	
1279-22113	April 28, 1973	5	64.19N	168.10W	39	161	Bering Sea - Ice	
1279-22115	April 28, 1973	10	62.58N	169.25W	40	160	St. Lawrence Island - Ice	
1280-20330	April 29, 1973	20	66.59N	140.51W	37	165	East of Black River	C
1280-20333	April 29, 1973	0	65.39N	142.21W	38	163	Charlie River	C
1280-20335	April 29, 1973	0	64.18N	143.43W	39	161	Delta - Eagle	C
1283-20495	May 2, 1973	0	68.16N	143.35W	36	167	Table Mtn	
1283-20502	May 2, 1973	0	66.58N	145.14W	28	165	Ft. Yukon	
1283-20504	May 2, 1973	5	65.37N	146.44W	39	163	Circle	C
1283-20513	May 2, 1973	15	62.55N	149.22W	41	159	Talkeetna Mtns	C
1284-20551	May 3, 1973	10	69.34N	143.12W	36	170	Demarcation Point	C
1284-20553	May 3, 1973	0	68.15N	145.02W	37	167	Arctic	C
1284-20560	May 3, 1973	0	66.56N	156.41W	38	165	Ft. Yukon	C
1284=20562	May 3, 1973	0	65.35N	148.11W	39	163	Livengood	C
1284-20565	May 3, 1973	0	64.15N	159.33W	40	161	McKinley	C
1284-20571	May 3, 1973	25	62.53N	150.47W	41.	159	Talkeetna	C
1285-21014	May 4, 1973	20	66.59N	148.02W	38	165	Beaver	C
1285-21021	May 4, 1973	5	65.39N	149.32W	39	163	Livengood	C
1285-21023	May 4, 1973	3	64.18N	150.54W	40	161	Kantishna River	C
1288-21210	May 7, 1973	3	60.12N	158.42W	45	156	Taylor Mtns	
1288-21212	May 7, 1973	1	58.49N	159.41W	46	154	Hagemeister Island, Nushagak Bay	
1291-21363	May 10,1973	5	65.35N	158.15W	41	163	Kateel River	C
1291-21370	May 10, 1973	5	64.14N	159.38W	42	161	Norton Bay, Nulato	C
1291-21372	May 10, 1973	5	62.52N	160.53W	43	159	Kwiguk, Holy Cross	C
1291-21375	May 10, 1973	5	61.30N	162.02W	44	157	Marshall, Russian Mission	C
1291-21381	May 10, 1973	10	60.07N	163.05W	45	155	Kuskokwim	
1293-21482	May 12, 1973	15	64.15N	162.27W	43	161	Norton Bay	
1293-21491	May 12, 1973	10	61.32N	164.50W	45	157	Marshall	
1293-21494	May 12, 1973	10	60.10N	165.53W	46	155	Nunivak Island	
1293-21500	May 12, 1973	10	58.47N	166.51W	47	153	Bering Sea	
1294-20121	May 13, 1973	10	60.08N	141.31W	46	155	Icy Bay	
1294-21541	May 13, 1973	0	64.14N	163.56W	43	161	Soloman	
1294-21543	May 13, 1973	10	62.53N	165.10W	44	159	Black	
1294-21550	May 13, 1973	0	61.31N	166.18W	45	157	Hooper Bay	
1294-21552	May 13, 1973	0	60.08N	167.21W	46	155	Nunivak Island	

1295-20161	May 14, 1973	0	65.38N	138.11W	42	163	East of Charley River	
1295-20163	May 14, 1973	0	64.17N	139.33W	43	161	East of Eagle	
1295-21572	May 14, 1973	0	72.09N	154.34W	36	175	North of Teshekpuk	
1295-21575	May 14, 1973	5	70.53N	156.55W	37	172	Meade River	
1295-21581	May 14, 1973	5	69.35N	158.59W	38	169	Ututok River, Lookout Ridge	
1295-21584	May 14, 1973	15	68.17N	160.50W	40	167	Misheguk Mtn	
1298-20323	May 17, 1973	0	68.19N	139.15W	40	167	East of Table Mtn.	C
1298-20325	May 17, 1973	2	67.00N	140.55W	41	165	Coleen, Black River	
1299-22224	May 18, 1973	2	64.18N	171.03W	44	161	Siberia, Bering Straits	
1300-20460	May 19, 1973	25	61.35N	149.01W	46	157	Anchorage	D
1300-22262	May 19, 1973	0	70.56N	164.02W	38	172	Point Lay	
1300-22265	May 19, 1973	0	69.39N	166.07W	40	169	Point Hope	C
1300-22271	May 19, 1973	5	68.28N	167.58W	41	67	Point Hope	C
1300-22274	May 19, 1973	20	67.01N	169.37W	42	165	Chukchi Sea	
1300-22280	May 19, 1973	15	65.41N	171.07W	43	163	Chukotsch Penn.	C
1304-21063	May 23, 1973	2	69.36N	146.04W	40	169	Mt. Michelson	C
1305-21115	May 24, 1973	5	70.52N	145.31W	39	172	Flaxman Is.	
1305-21121	May 24, 1973	20	69.35N	147.35W	41	169	Sagavanirktok, Mt. Michelson	
1305-21133	May 24, 1973	0	65.36N	152.36W	44	162	Tanana	
1307-19434	May 26, 1973	0	58.46N	135.17W	50	152	Juneau	C
1307-21231	May 26, 1973	3	70.53N	148.15W	40	172	Beechey Point	D+C
1308-21290	May 27, 1973	0	70.55N	149.37W	40	172	Beechey Point	D
1308-21292	May 27, 1973	0	69.38N	151.41W	41	169	Umiat	D
1308-21295	May 27, 1973	5	68.20N	153.32W	42	167	Killik River, Chandler	
1308-21301	May 27, 1973	5	67.00N	155.12W	43	164	Survey Pass, Hughes	
1308-21310	May 27, 1973	15	64.19N	158.05W	46	160	Nulato	
1308-21313	May 27, 1973	20	62.57N	159.21W	47	158	Holy Cross, Iditarod	
1311-21472	May 30, 1973	0	66.57N	159.41W	44	164	Selawik, Shungnak	C
1311-21475	May 30, 1973	20	65.36N	161.10W	45	162	Selawik	C
1311-21481	May 30, 1973	0	64.15N	162.30W	46	160	Soloman, Norton Bay	C
1312-20113	May 31, 1973	20	61.32N	140.28W	48	156	McCarthy & East	C
1312-21524	May 31, 1973	0	68.18N	159.24W	43	166	Misheguk Mtn, Howard Pass	C
1312-21531	May 31, 1973	0	66.58N	161.04W	44	164	Misheguk Mtn	C
1312-21533	May 31, 1973	20	65.37N	162.34W	45	162	Bendelben, Candle	C
1313-21582	June 1, 1973	0	68.16N	160.54W	43	166	Misheguk Mtn	C
1313-21585	June 1, 1973	5	66.57N	162.30W	44	164	Kotzebue	C
1314-22041	June 2, 1973	5	68.18N	162.17W	43	166	DeLong Mtn, Misheguk	

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1314-22043	June 2, 1973	0	66.59N	163.55W	44	164	Kotzebue	C
1317-20374	June 5, 1973	0	69.38N	138.56W	42	168	Canada, Herschel Island	
1317-22203	June 5, 1973	0	70.55N	162.38W	41	171	Wainwright	
1318-20432	June 6, 1973	20	69.38N	140.20W	42	168	Herschel Island	C
1323-19320	June 11, 1973	15	58.49N	132.26W	51	150	Taku River	C
1326-21284	June 14, 1973	0	70.50N	149.51W	42	170	Beechey Point	C + D
1326-21291	June 14, 1973	5	69.32N	151.55W	43	168	Umiat	D
1326-21305	June 14, 1973	5	64.12N	158.14W	47	158	Nulato	
1326-21311	June 14, 1973	5	62.50N	159.28W	48	156	Holy Cross	C
1228-20004	June 16, 1973	20	58.42N	139.38W	52	150	Yakutat	
1328-21413	June 16, 1973	5	66.54N	158.15W	45	163	Shungnak	
1328-21415	June 16, 1973	1	65.33N	159.44W	46	160	Candle - Kateel	
1328-21422	June 16, 1973	0	64.12N	161.05W	47	158	Norton Bay	
1329-21455	June 17, 1973	20	70.51N	154.04W	42	170	Teshekpuk	C
1329-21462	June 17, 1973	3	69.33N	156.08W	43	167	Lookout Ridge	C
1329-21464	June 17, 1973	3	68.15N	157.57W	44	165	Howard Pass	
1329-21471	June 17, 1973	0	66.55N	159.36W	45	163	Selawik	C
1329-21473	June 17, 1973	10	65.35N	161.06W	46	160	Candle	C
1330-21523	June 18, 1973	5	68.13N	159.32W	44	165	Misheguk Mtn, Howard Pass	C
1330-21525	June 18, 1973	0	66.52N	161.13W	45	162	Selawik	C + D
1334-22155	June 22, 1973	5	66.54N	166.52W	45	162	Shishmaref	C
1334-22161	June 22, 1973	0	65.34N	168.22W	46	160	Teller	C
1334-22164	June 22, 1973	0	64.13N	169.44W	47	158	St. Lawrence	C
1335-22201	June 23, 1973	10	70.51N	162.45W	42	170	Wainwright	
1335-22215	June 23, 1973	2	65.34N	169.48W	46	160	Teller, Little & Big Diomede	C
1335-22222	June 23, 1973	2	64.13N	171.09W	47	158	St. Lawrence Island	C
1335-22224	June 23, 1973	0	62.51N	172.23W	48	155	St. Lawrence Island	C
1335-22231	June 23, 1973	5	61.30N	173.31W	50	153	St. Matthews	
1336-20440	June 24, 1973	10	66.51N	143.56W	45	162	Black River	C
1336-22262	June 24, 1973	15	69.29N	166.17W	43	187	Point Hope	
1336-22274	June 24, 1973	1	65.30N	171.13W	46	160	Siberia	
1336-22280	June 24, 1973	0	64.09N	172.34W	47	157	Siberia, St. Lawrence	
1337-22330	June 25, 1973	0	66.54N	171.10W	45	162	Siberia	C
1337-22332	June 25, 1973	0	65.34N	172.40W	46	160	Siberia	C
1337-22335	June 25, 1973	0	64.12N	174.02W	47	157	Siberia	C
1339-20595	June 27, 1973	20	70.50N	142.43W	42	169	Barter Island	
1339-22424	June 27, 1973	0	72.06N	166.07W	41	172	Chukchi Sea	
1339-22431	June 27, 1973	0	70.51N	168.27W	42	169	Chukchi Sea	
1339-22433	June 27, 1973	0	69.33N	170.32W	43	167	Chukchi Sea	
1339-22440	June 27, 1973	0	68.15N	172.22W	44	164	Chukchi Sea	
1339-22442	June 27, 1973	0	66.55N	174.01	45	162	Siberia	
1341-21130	June 29, 1973	10	65.33N	152.39W	46	159	Tanana	C
1341-21135	June 29, 1973	20	62.49N	155.14W	48	155	McGrath	C
1341-21141	June 29, 1973	5	61.28N	156.23W	49	153	Sleetmute, Lime Hills	C
1341-21144	June 29, 1973	5	60.03N	157.05W	50	151	Taylor Mts.	
1342-21170	June 30, 1973	15	70.49N	147.01W	42	196	Beechey Pt., Flaxman Is.	C
1342-21173	June 30, 1973	15	69.31N	149.04W	43	166	Sagavanirktok	C + D
1342-21191	June 30, 1973	10	64.11N	155.23W	47	157	Ruby	C
1342-21193	June 30, 1973	20	62.49N	156.37W	48	155	Iditarod, McGrath	C
1344-21283	July 2, 1973	0	70.49N	149.53W	42	169	Beechey Point	C + D
1344-21290	July 2, 1973	2	69.31N	151.57W	43	166	Umiat	C
1344-21292	July 2, 1973	0	68.12N	153.47W	44	164	Chandler Lake	C
1345-21342	July 3, 1973	5	70.44N	151.30W	41	169	Harrison Bay	C
1345-21344	July 3, 1973	20	69.27N	153.33W	43	166	Ikpikpuk River	C
1345-21351	July 3, 1973	10	68.08N	155.22W	44	164	Killik River	C
1345-21353	July 3, 1973	10	66.48N	157.00W	45	161	Shungnak	C
1345-21360	July 3, 1973	15	65.28N	158.28W	46	159	Kateel River	C
1345-21362	July 3, 1973	10	64.07N	159.48W	47	157	Norton Bay, Nulato	C
1346-21420	July 4, 1973	20	64.07N	161.10W	47	157	Norton Bay	
1346-21425	July 4, 1973	20	61.24N	163.31W	49	153	Marshall	C
1349-21564	July 7, 1973	0	71.59N	154.54W	40	172	Barrow	
1350-20223	July 8, 1973	2	61.24N	143.26W	48	153	McCarthy	C
1351-20275	July 9, 1973	10	62.41N	143.48W	47	155	Nabesna	D
1351-20282	July 9, 1973	5	61.19N	144.56W	48	152	Valdez, McCarthy	C + D
1352-20333	July 10, 1973	5	62.14N	145.14W	47	155	Gulkana	C + D
1352-20340	July 10, 1973	10	61.22N	146.21W	48	153	Valdez	
1352-20342	July 10, 1973	15	60.00N	147.23W	49	150	Seward, Cordova	
1354-22275	July 12, 1973	20	64.08N	172.39W	46	157	Siberia, St. Lawrence Island	
1356-20540	July 14, 1973	0	70.44N	141.22W	40	168	Barter Island	
1358-19262	July 16, 1973	2	57.14N	131.58W	50	147	East of Sumdum	
1358-19264	July 16, 1973	0	55.51N	132.49W	51	145	Craig, Ketchikan	C + D
1358-19271	July 16, 1973	0	54.27N	133.37W	52	142	Dixon Entrance	C
1358-21052	July 16, 1973	20	70.44N	144.18W	40	168	Flaxman Island	

1358-21073	July 16, 1973	20	64.07N	152.32W	45	157	Kantishna River	C
1358-21075	July 16, 1973	2	62.46N	153.45W	46	155	McGrath	C
1358-21082	July 16, 1973	20	61.24N	154.53W	47	153	Lime Hills	
1362-21305	July 20, 1973	5	62.43N	159.34W	46	155	Holy Cross, Iditarod	C
1363-21354	July 21, 1973	0	65.25N	158.32W	43	159	Kateel River	C
1363-21363	July 21, 1973	0	62.43N	161.04W	45	155	Holy Cross	C
1363-21370	July 21, 1973	15	61.20N	162.10W	46	153	Russian Mission	C
1365-20051	July 23, 1973	20	61.21N	139.07W	46	153	Burwash Landing	C
1370-20314	July 28, 1973	10	68.07N	139.35W	40	163	E. of Table Mtn	
1374-19150	August 1, 1973	0	55.47N	129.59W	48	146	East of Ketchikan	C
1375-20595	August 2, 1973	10	69.24N	144.57W	37	166	Flaxman Island	D
1375-21002	August 2, 1973	15	68.05N	146.46W	38	164	Arctic	D
1384-21533	August 11, 1973	5	62.39N	165.14W	40	156	Black, Kwiguk	
1386-22031	August 13, 1973	15	68.03N	162.32W	35	164	DeLong Mts.	
1387-20275	August 14, 1973	15	61.20N	144.54W	41	155	Valdez	D
1387-20281	August 14, 1973	0	59.58N	145.56W	42	153	Cordova, Middleton Is.	C + D
1387-20284	August 14, 1973	0	58.35N	146.54W	43	152	Gulf of Alaska	
1387-22090	August 14, 1973	5	68.04N	163.58W	35	165	DeLong Mt.	C
1387-22095	August 14, 1973	20	65.22N	167.05W	37	160	Teller	C
1388-20333	August 15, 1973	2	61.20N	146.18W	40	155	Valdez	C + D
1388-20335	August 15, 1973	3	59.58N	147.20W	41	153	Blying Sound	D
1388-20342	August 15, 1973	0	58.35N	148.18W	42	152	Gulf of Alaska	
1389-20364	August 16, 1973	15	69.23N	139.06W	33	167	Herschel Is.	
1389-20373	August 16, 1973	10	66.45N	142.32W	36	163	Black River	C
1389-20380	August 16, 1973	20	65.25N	144.00W	37	161	Circle	
1389-20394	August 16, 1973	5	59.59N	148.45W	41	154	Seward	D - C
1390-20450	August 17, 1973	10	61.22N	149.09W	40	156	Anchorage	C + D
1390-20452	August 17, 1973	0	60.00N	150.12W	41	154	Kenai	C + D
1392-19145	August 19, 1973	5	55.49N	129.59W	43	149	East of Ketchikan	C
1392-19151	August 19, 1973	0	54.24N	130.46W	44	148	SE, Prince Rupert	C
1396-21162	August 23, 1973	20	70.41N	147.08W	30	170	Beechey Pt., Flaxman Island	D + C
1396-21165	August 23, 1973	20	69.24N	149.09W	31	168	Sagavanirktok	—
1406-20320	September 2, 1973	10	65.29N	142.29W	31	163	Charley River	
1406-20334	September 2, 1973	3	60.01N	147.15W	35	157	Seward, Cordova	C
1406-20340	September 2, 1973	10	58.38N	148.14W	36	155	Gulf of Alaska	
1406-22131	September 2, 1973	5	72.02N	159.04W	25	174	Arctic Ocean	
1406-22142	September 2, 1973	20	68.09N	165.14W	29	167	Point Hope	
1406-22145	September 2, 1973	5	66.50N	166.53W	30	165	Shishmaref	
1407-20371	September 3, 1973	20	66.49N	142.28W	29	165	Black River	D
1407-20374	September 3, 1973	2	65.28N	143.57W	31	163	Charley River	C + D
1407-20380	September 3, 1973	15	64.07N	145.17W	32	161	Delta	C + D
1407-20383	September 3, 1973	20	62.46N	146.31W	33	160	Gulkana	D
1407-22191	September 3, 1973	60	70.44N	162.44W	26	171	Wainwright, clds over water, land clear	
1407-22194	September 3, 1973	15	69.27N	164.46W	29	169	Point Lay	
1407-22200	Sept. 3, 1973	20	68.08N	166.35W	28	167	Point Hope, clds over water, land clear	
1408-20423	Sept. 4, 1973	15	68.08N	142.12W	28	167	Table Mt.	
1408-20430	Sept. 4, 1973	0	66.49N	143.51W	29	165	Black River	C + D
1408-20432	Sept. 4, 1973	20	65.29N	145.20W	30	163	Circle	C
1408-20435	Sept. 4, 1973	5	64.07N	146.42W	31	162	Fairbanks - Delta	C + D
1411-21003	Sept. 7., 1973	5	65.28N	149.37W	29	164	Livengood	C + D
1412-21082	Sept. 8, 1973	10	58.38N	156.47W	34	156	Naknek	
1413-21113	Sept. 9, 1973	20	66.49N	151.02W	27	166	Bettles	D
1413-21120	Sept. 9, 1973	20	65.29N	152.31W	28	164	Tanana	C + D
1413-21134	Sept. 9, 1973	5	60.02N	157.18W	33	158	Taylor Mts. - Lake Clark	C
1414-21162	Sept. 10, 1973	15	69.28N	149.00W	25	170	Sagavanirktok	
1415-19421	Sept. 11, 1973	20	58.37N	135.15W	33	157	Juneau	
1415-19424	Sept. 11, 1973	0	57.13N	136.10W	35	156	Sitka	
1416-19473	Sept. 12, 1973	0	60.01N	135.49W	32	158	Skagway	
1416-19480	Sept. 12, 1973	0	58.36N	136.47W	33	157	Mt. Fairweather	C
1416-19482	Sept. 12, 1973	5	57.11N	137.41W	34	156	Sitka, Gulf of Alaska	
1417-19525	Sept. 13, 1973	0	61.22N	136.08W	30	160	Canada, Lake LeBarge, etc.	
1417-19531	Sept. 13, 1973	0	59.59N	137.11W	32	159	Skagway	
1417-19534	Sept. 13, 1973	0	58.37N	138.09W	33	157	Mt. Fairweather	
1419-20035	Sept. 15, 1973	0	62.44N	137.54W	29	162	Canada, E. of Tanacross	
1419-20041	Sept. 15, 1973	0	61.21N	139.01W	30	160	Mt. St. Elias	C
1420-20093	Sept. 16, 1973	1	62.47N	139.17W	28	162	E. of Nabesna	C
1422-20201	Sept. 18, 1973	0	65.33N	139.33W	25	165	E. of Charley River	
1422-20203	Sept. 18, 1973	0	64.12N	140.55W	26	164	Eagle	C + D
1422-20210	Sept. 18, 1973	0	62.51N	142.09W	27	162	Nabesna	C
1422-20212	Sept. 18, 1973	0	61.28N	143.17W	29	161	McCarthy	C + D
1422-20215	Sept. 18, 1973	20	60.05N	144.19W	30	160	Cordova, Bering Glacier, land clear	C
1423-20252	Sept. 19, 1973	5	66.55N	139.21W	23	167	E. of Black River	
1423-20255	Sept. 19, 1973	0	65.34N	140.51W	25	166	Charley River	D + C
1423-20261	Sept. 19, 1973	5	64.13N	142.13W	26	164	Eagle	D + C
1423-20264	Sept. 19, 1973	20	62.51N	143.28W	27	162	Nabesna	
1423-20270	Sept. 19, 1973	5	61.29N	144.27W	28	161	Valdez, McCarthy	
1424-20340	Sept. 20, 1973	2	57.21N	148.55W	31	157	Gulf of Alaska	
1426-20453	Sept. 22, 1973	20	57.18N	151.50W	30	158	Kodiak	
1427-20511	Sept. 23, 1973	10	57.20N	153.19W	30	158	Karluk, Kodiak	C
1428-20551	Sept. 24, 1973	20	62.50N	150.38W	25	163	Talkeetna	
1428-20554	Sept. 24, 1973	7	61.27N	151.47W	26	162	Tyonek	C - D

1428-20560	Sept. 24, 1973	0	60.05N	152.50W	27	161	Kenai	
1428-20563	Sept. 24, 1973	0	58.42N	153.56W	29	159	Mt. Katmai, Afognak	
1428-20565	Sept. 28, 1973	4	57 19N	154.45W	30	158	Karluk, Kodiak	
1432-21160	Sept. 28, 1973	0	69.30N	148.44W	18	172	Sagavanirktok	D
1434-19170	Sept. 30, 1973	0	60.04N	135.36W	25	162	Skagway	C
1434-19473	Sept. 30, 1973	10	58.41N	136.35W	26	160	Mt. Fairweather	C
1434-19475	Sept. 30, 1973	10	57.18N	137.30W	28	159	Sitka	
1439-21565	Oct. 5, 1973	3	66.52N	162.18W	17	169	Kotzebue, Selawik	
1440-22021	Oct. 6, 1973	0	68.10N	162.06W	16	171	DeLong Mt.	
1440-22023	Oct. 6, 1973	5	66.50N	163.46W	17	169	Kotzebue	
1441-20270	Oct. 7, 1973	20	60.01N	145.40W	23	162	Cordova	
1441-22072	Oct. 7, 1973	10	69.26N	161.44W	14	173	Utukok River	
1441-22075	Oct. 7, 1973	0	68.07N	163.33W	15	171	DeLong Mt.	
1441-22081	Oct. 7, 1973	10	66.48N	165.11W	17	169	Kotzebue, Shishmaref	
1442-20310	Oct. 8, 1973	5	65.30N	142.16W	17	168	Charley River	
1442-22131	Oct. 8, 1973	20	69.28N	163.12W	14	173	Point Lay	
1443-20385	Oct. 9, 1973	5	58.44N	149.25W	23	162	Tip of Seldovia	
1446-20562	Oct. 12, 1973	20	57.21N	154.35W	23	161	Karluk	
1449-21094	Oct. 15, 1973	20	69.34N	147.03W	11	173	Mt. Michelson	
1449-21101	Oct. 15, 1973	0	68.15N	149.02W	12	172	Philip Smith Mt.	
1449-21103	Oct. 15, 1973	10	66.56N	150.41W	14	170	Wiseman	
1449-21110	Oct. 15, 1973	10	65.36N	152.12W	15	168	Tanana	
1449-21112	Oct. 15, 1973	5	64.15N	153.34W	16	167	Ruby, Kantishna	
1449-21121	Oct. 15, 1973	20	61.32N	155.58W	18	165	Lime Hills	
1449-21130	Oct. 15, 1973	20	58.46N	158.01W	21	162	Dillingham	
1449-21133	Oct. 15, 1973	10	57.22N	158.55W	22	161	Ugashik	
1449-21135	Oct. 15, 1973	60	55.58N	159.46W	23	160	Chignik, crater clear	
1451-19411	Oct. 17, 1973	15	58.45N	135.02W	20	163	Juneau	
1451-19414	Oct. 17, 1973	5	57.21N	135.57W	21	162	Sitka	
1455-20034	Oct. 21, 1973	20	60.07N	139.46W	18	164	Yakutat	D
1455-20040	Oct. 21, 1973	5	58.44N	140.45W	19	163	Gulf of Alaska	
1455-21442	Oct. 21, 1973	1	68.13N	157.36W	10	172	Howard Pass	
1455-21445	Oct. 21, 1973	20	66.54N	159.16W	11	170	Selawik	
1456-20092	Oct. 22, 1973	5	60.08N	141.13W	17	164	Bering Glacier	
1457-20144	Oct. 23, 1973	0	61.28N	141.34W	16	165	McCarthy	
1457-20150	Oct. 23, 1973	0	60.06N	142.37W	17	164	Bering Glacier	
1458-20191	Oct. 24, 1973	0	65.33N	139.15W	12	169	E. of Charley River	
1458-20202	Oct. 24, 1973	0	61.28N	143.01W	15	165	McCarthy	
1458-20205	Oct. 24, 1973	15	60.06N	144.05W	17	164	Cordova	
1459-20260	Oct. 25, 1973	20	61.28N	144.27W	15	165	Valdez, McCarthy	
1460-20303	Oct. 26, 1973	1	65.30N	142.13W	11	169	Charley River	
1461-20353	Oct. 27, 1973	10	68.11N	140.30W	08	172	Table Mt.	
1461-20362	Oct. 27, 1973	10	65.30N	143.38W	11	169	Charley River	
1461-20364	Oct. 27, 1973	15	64.09N	144.59W	12	168	Big Delta	D
1464-20554	Oct. 30, 1973	2	58.39N	153.43W	16	164	Afognak	
1465-19185	Oct. 31, 1973	15	55.53N	131.05W	18	162	Ketchikan	
1465-20591	Oct. 31, 1973	20	65.30N	149.21W	09	169	Livengood, Fairbanks	
1465-21003	Oct. 31, 1973	10	61.26N	153.07W	13	166	Lime Hills	
1466-19244	Nov. 1, 1973	10	55.54N	132.30W	18	162	Craig	
1466-21061	Nov. 1, 1973	15	61.26N	154.32W	13	166	Lake Clark	
1466-21064	Nov. 1, 1973	10	60.04N	155.35W	14	165	Lake Clark	
1467-19300	Nov. 2, 1973	0	57.14N	133.08W	16	163	Sumdum	
1467-19302	Nov. 2, 1973	0	55.51N	133.58W	17	162	Craig	
1467-21104	Nov. 2, 1973	5	65.28N	152.16W	09	169	Tanana	
1467-21111	Nov. 2, 1973	0	64.08N	153.37W	10	168	Ruby, Kantishna R.	
1467-21113	Nov. 2, 1973	20	62.46N	154.52W	20	167	McGrath	
1467-21120	Nov. 2, 1973	5	61.24N	156W	12	166	Sleetmute, Lime Hills	
1468-19352	Nov. 3, 1973	5	58.38N	133.41W	15	164	Taku River	
1468-19354	Nov. 3, 1973	0	57.15N	134.35W	16	163	Sitka	
1468-19361	Nov. 3, 1973	0	55.49N	135.20W	17	162	Sitka	
1468-21163	Nov. 3, 1973	0	65.30N	153.46W	08	169	Melozitna	
1468-21165	Nov. 3, 1973	10	64.09N	155.07W	10	168	Medfra	
1468-21190	Nov. 3, 1973	10	57.16N	160.26W	16	161	Chignik	
1469-19404	Nov. 4, 1973	10	60.02N	134.09W	13	165	Carcross	
1469-19410	Nov. 4, 1973	15	58.39N	135.07W	14	164	Juneau	
1469-19413	Nov. 4, 1973	0	57.15N	136.00W	15	163	Sitka	
1469-21221	Nov. 4, 1973	0	65.29N	155.08W	08	169	Melozitna	
1469-21224	Nov. 4, 1973	5	64.08N	[illegible].30W	09	168	Nulato - Ophir	
1469-21230	Nov. 4, 1973	5	62.47N	157.45W	11	167	Iditarod	
1469-21233	Nov. 4, 1973	20	61.25N	158.55W	12	166	Sleetmute	
1470-21285	Nov. 5, 1973	10	62.46N	159.09W	10	167	Iditarod	
1470-21294	Nov. 5, 1973	3	60.02N	161.22W	13	165	Bethel	
1471-19520	Nov. 6, 1973	0	60.03N	137.00W	12	165	Skagway	
1472-19572	Nov. 7, 1973	0	61.23N	137.25W	11	166	Haines Junction	
1472-19575	Nov. 7, 1973	0	60.00N	138.27W	12	165	Yakutat	
1474-20092	Nov. 9, 1973	0	59.58N	141.1[illegible]W	12	165	Bering Glacier, Icy Bay	
1477-20260	Nov. 12, 1973	0	61.20N	144.34W	10	166	McCarthy	
1477-20263	Nov. 12, 1973	0	59.58N	145.38W	11	165	Cordova	
1477-20265	Nov. 12, 1973	0	58.35N	146.36W	12	164	Gulf of Alaska	
1478-20315	Nov. 13, 1973	0	61.19N	146.03W	09	166	Valdez	
1478-20321	Nov. 13, 1973	10	59.57N	147.06W	11	165	Blying Sound	
1479-20373	Nov. 14, 1973	0	61.19N	147.31W	09	166	Valdez, Anchorage	D
1479-20380	Nov. 11, 1973	5	59.56N	148.34W	10	165	Blying Sound	
1483-19185	Nov. 18, 1973	20	55.43N	131.13W	13	162	Ketchikan	

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1535-19062	January 9, 1974	0	55.45N	128.22W	09	158	East of Ketchikan
1555-19171	January 29, 1974	10	55.55N	131.07W	13	155	Ketchikan
1555-19173	January 29, 1974	10	54.31N	131.55W	14	154	Prince Rupert
1555-20591	January 29, 1974	0	60.04N	154.12W	10	158	Illiamna
1555-20593	January 29, 1974	0	58.41N	155.11W	11	157	Mt. Katmai
1556-19222	January 30, 1974	0	57.20N	131.41W	12	156	East of Sumdum
1556-19225	January 30, 1974	3	55.57N	132.32W	13	155	Craig
1560-21274	February 3, 1974	10	60.07N	161.16W	11	157	Bethel
1560-21280	February 3, 1974	20	58.44N	162.15W	12	156	Hagemeister Island
1565-21525	February 8, 1974	0	70.54N	156.31W	03	168	Barrow
1565-21532	February 8, 1974	5	69.37N	158.37W	04	166	Lookout Ridge
1565-21534	February 8, 1974	20	68.18N	160.29W	06	164	Misheguk Mt.
1565-21541	February 8, 1974	10	66.59N	162.07W	07	163	Selawik - Noatak
1565-21543	February 8, 1974	5	65.39N	163.38W	08	162	Bendeleben
1565-21550	February 8, 1974	0	64.18N	164.59W	09	160	Nome - Solomon
1565-21552	February 8, 1974	5	62.57N	166.14W	10	159	Black
1565-21555	February 8, 1974	20	61.35N	167.23W	11	158	Hooper Bay
1566-21593	February 9, 1974	20	68.17N	161.54W	06	164	Misheguk Mt.
1566-21595	February 9, 1974	0	66.58N	163.33W	07	163	Noatak - Kotzebue
1566-22002	February 9, 1974	10	65.37N	165.03W	08	161	Bendleben
1567-22051	February 10, 1974	5	68.18N	163.18W	06	164	DeLong Mt.
1567-22053	February 10, 1974	20	66.59N	164.59W	07	163	Kotzebue
1567-22060	February 10, 1974	0	65.39N	166.29W	08	161	Teller
1567-22062	February 10, 1974	0	64.18N	167.51W	10	160	Nome
1567-22065	February 10, 1974	3	62.56N	169.06W	11	159	St. Lawrence Is.
1568-22123	February 11, 1974	0	62.55N	170.35W	11	159	St. Lawrence Is.
1573-20580	February 16, 1974	10	62.51N	151.59W	13	159	Mt. McKinley - Talkeetna
1573-20582	February 16, 1974	2	61.29N	153.01W	14	157	Lime Hills - Tyonek
1574-21031	February 17, 1974	0	64.15N	152.10W	12	160	Kantishna River
1574-21034	February 17, 1974	5	62.54N	153.25W	13	158	McGrath
1574-21040	February 17, 1974	0	61.32N	154.34W	14	157	Lime Hills
1574-21043	February 17, 1974	2	60.09N	155.36W	15	156	Lake Clark
1575-21090	February 18, 1974	0	64.12N	153.37W	12	160	Kantishna River
1575-21092	February 18, 1974	0	62.[illegible]N	154.52W	13	158	McGrath
1575-21095	February 18, 1974	0	61.[illegible]3N	156.00W	15	157	Sleetmute - Lime Hills
1575-21101	February 18, 1974	0	60.[illegible]N	157.04W	16	156	Taylor Mts.
1575-21104	February 18, 1974	0	58.43N	158.02W	17	155	Nushagak Bay
1576-21135	February 19, 1974	0	66.56N	152.10W	10	162	Bettles
1576-21142	February 19, 1974	0	65.35N	153.39W	12	161	Melozitna
1576-21144	February 19, 1974	0	64.14N	154.59W	13	160	Ruby
1576-21151	February 19, 1974	0	62.52N	156.14W	14	158	Iditarod - McGrath
1576-21153	February 19, 1974	0	61.31N	157.23W	15	157	Sleetmute
1576-21160	February 19, 1974	0	60.08N	158.27W	16	156	Taylor Mts.
1576-21162	February 19, 1974	5	58.46N	159.27W	17	155	Nushagak Bay
1577-21191	February 20, 1974	0	68.16N	151.54W	10	164	Chandler Lake
1577-21193	February 20, 1974	0	66.57N	153.34W	11	162	Hughes
1577-21200	February 20, 1974	0	65.36N	155.05W	12	161	Melozitna
1577-21202	February 20, 1974	0	64.15N	156.27W	13	160	Nulato - Ruby
1577-21205	February 20, 1974	0	62.53N	157.41W	14	158	Ophir - Iditarod
1577-21211	February 20, 1974	0	61.31N	158.50W	15	157	Sleetmute
1577-21214	February 20, 1974	2	60.09N	159.53W	16	156	Taylor Mts.
1577-21220	February 20, 1974	5	58.46N	160.52W	17	155	Hagemeister Island
1578-21245	February 21, 1974	0	68.17N	153.18W	10	164	Killik River
1578-21252	February 21, 1974	0	66.58N	154.58W	11	162	Hughes
1578-21254	February 21, 1974	0	65.38N	156.29W	12	161	Kateel River
1578-21261	February 21, 1974	0	64.17N	157.51W	13	160	Nulato
1578-21263	February 21, 1974	0	62.55N	159.06W	14	158	Iditarod
1578-21270	February 21, 1974	0	61.33N	160.15W	16	157	Russian Mission
1578-21272	February 21, 1974	0	60.11N	161.19W	17	156	Bethel
1578-21275	February 21, 1974	0	58.48N	162.18W	18	155	Hagemeister Island
1578-21281	February 21, 1974	0	57.24N	163.13W	19	154	Bering Strait
1579-21304	February 22, 1974	0	68.16N	154.48W	10	164	Killik River
1579-21310	February 22, 1974	0	66.56N	156.27W	12	162	Shungnak
1579-21313	February 22, 1974	10	65.36N	157.57W	13	161	Kateel River
1579-21315	February 22, 1974	0	64.15N	159.19W	14	160	Norton Bay - Nulato
1579-21322	February 22, 1974	5	62.53N	160.34W	15	158	Holy Cross
1579-21324	February 22, 1974	20	61.31N	161.43W	16	157	Russian Mission
1579-21331	February 22, 1974	25	60.08N	162.47W	17	156	Baird Inlet
1580-21362	February 23, 1974	0	68.16N	156.05W	11	164	Howard Pass - Killik River
1580-21364	February 23, 1974	0	66.57N	157.46W	12	162	Shungnak
1580-21371	February 23, 1974	0	65.37N	159117W	13	161	Candle - Kateel River
1580-21373	February 23, 1974	0	64.16N	160.40W	14	160	Norton Bay
1580-21380	February 23, 1974	0	62.55N	161.56W	15	158	Unalakleet
1580-21382	February 23, 1974	0	61.33N	163.06W	16	157	Marshall
1580-21385	February 23, 1974	5	60.10N	164.09W	17	156	Baird Inlet
1581-21420	February 24, 1974	0	68.17N	157.33W	11	164	Howard Pass
1581-21423	February 24, 1974	0	66.58N	159.13W	12	162	Selawik
1581-21425	February 24, 1974	0	65.38N	160.44W	13	161	Candle
1581-21432	February 24, 1974	0	64.17N	162.06W	14	160	Norton Bay
1581-21434	February 24, 1974	5	62.56N	163.21W	16	158	Kwiguk

1581-21443	February 24, 1974	10	60.11N	165.36W	18	156	Nunivak Island
1581-21450	February 24, 1974	0	58.49N	166.36W	19	155	Bering Sea
1582-21474	February 25, 1974	0	68.18N	158.55W	12	164	Howard Pass
1582-21481	February 25, 1974	0	67.00N	160.36W	13	162	Baird Mts.
1582-21483	February 25, 1974	0	65.40N	162.00W	14	161	Bendeleben - Candle
1582-21490	February 25, 1974	0	64.19N	163.32W	15	160	Solomon
1582-21492	February 25, 1974	0	62.57N	164.49W	16	158	Kwiguk
1583-20122	February 26, 1974	20	61.32N	141.40W	17	157	McCarthy
1583-20124	February 26, 1974	0	60.10N	142 43W	18	156	Bering Glacier
1583-21521	February 26, 1974	0	72.07N	154.12W	09	170	Arctic Ocean
1583-21524	February 26, 1974	0	70.51N	156.33W	10	168	Wainwright
1583-21530	February 26, 1974	0	69.34N	158.38W	11	166	Lookout Ridge
1583-21533	February 26, 1974	10	68.16N	160.29W	12	164	Misheguk Mtn.
1583-21553	February 26, 1974	5	61.31N	167.28W	17	157	Hooper Bay
1584-20165	February 27, 1974	15	65.37N	139.16W	14	161	East of Charley River
1584-20174	February 27, 1974	2	62.54N	141.52W	17	158	Nabesna
1584-20180	February 27, 1974	10	61 32N	143.02W	18	157	McCarthy
1584-22005	February 27, 1974	10	62.54N	167.40W	17	158	St. Lawrence Island
1586-20275	March 1, 1974	0	66.58N	140.38W	14	162	Black River
1586-20281	March 1, 1974	0	65.37N	142.09W	15	161	Charley River
1586-20284	March 1, 1974	0	64.16N	143.32W	16	159	Eagle
1586-20290	March 1, 1974	0	62.55N	144.47W	17	158	Gulkana
1586-20293	March 1, 1974	0	61.33N	145.56W	18	157	Valdez
1586-20295	March 1, 1974	2	60.10N	147.00	20	156	Seward
1586-22095	March 1, 1974	0	70.51N	160.48W	11	168	Wainwright
1586-22101	March 1, 1974	0	69.34N	162.53W	12	166	Point Lay
1586-22104	March 1, 1974	0	68.16N	164.44W	13	164	Point Hope
1586-22110	March 1, 1974	0	66.46N	166.25W	14	162	Shishmaref
1586-22113	March 1, 1974	5	65.36N	167.55W	15	161	Teller
1586-22115	March 1, 1974	15	64.15N	169.17W	16	159	Bering Straits
1587-20330	March 2, 1974	0	68.17N	140.24W	13	164	East of Table Mts.
1587-20333	March 2, 1974	0	66.57N	142.04W	15	162	Black River
1587-20335	March 2, 1974	0	65.37N	143.35W	16	161	Charley River
1587-22153	March 2, 1974	0	70.52N	162.17W	11	168	Wainwright
1587-22160	March 2, 1974	0	69.35N	164.22W	12	166	Point Lay
1587-22162	March 2, 1974	0	68.17N	166.14W	13	164	Point Hope
1589-22281	March 4, 1974	5	66.57N	170.42W	15	162	Chukotsch Peninsula
1590-20493	March 5, 1974	0	70.47N	140.54W	12	168	Arctic Ocean
1590-20495	March 5, 1974	0	69.30N	142.59W	14	166	Demarcation Point
1590-20502	March 5, 1974	0	68.12N	144.51W	15	164	Arctic
1590-20504	March 5, 1974	0	66.52N	146.30W	16	162	Fort Yukon
1590-20511	March 5, 1974	0	65.32N	148.00W	17	161	Livengood - Fairbanks
1590-20522	March 5, 1974	20	61.27N	151.45W	20	157	Tyonek
1591-19160	March 6, 1974	5	57.19N	130.18W	24	153	Bradfield Canal
1592-19212	March 7, 1974	0	58.44N	130.50W	23	154	East of Taku River
1592-19215	March 7, 1974	0	57.20N	131.45W	24	153	East of Sumdum
1592-19221	March 7, 1974	0	55.57N	132.36W	25	152	Craig
1592-21005	March 7, 1974	0	70.48N	143.44W	13	168	Barter Island
1592-21012	March 7, 1974	0	69.31N	145.49W	14	166	Mt. Michelson
1592-21014	March 7, 1974	0	68.12N	147.40W	15	164	Philip Smith Mtns
1592-21021	March 7, 1974	5	66.53N	149.20W	17	162	Beaver
1592-21023	March 7, 1974	0	65.33N	150.50W	18	161	Tanana, Livengood
1592-21030	March 7, 1974	0	64.12N	152.13W	19	159	Kantishna River
1592-21032	March 7, 1974	15	62.50N	153.28W	20	158	McGrath
1593-19270	March 8, 1974	0	58.43N	132.16W	23	154	Taku River
1593-21063	March 8, 1974	20	70.49N	145.15W	14	168	Flaxman Island
1593-21075	March 8, 1974	0	66.54N	150.49W	17	162	Bettles
1593-21081	March 8, 1974	0	65.34N	152.19W	18	161	Tanana
1593-21084	March 8, 1974	0	64.13N	153.41N	19	159	Ruby - Kantishna River
1593-21090	March 8, 1974	0	62.51N	154.56W	20	158	McGrath
1593-21093	March 8, 1974	0	61.29N	156.04W	21	157	Sleetmute - Lime Hills
1593-21095	March 8, 1974	15	60.06N	157.06W	22	155	Taylor Mts.
1594-21122	March 9, 1974	0	70.49N	146.36W	14	168	Flaxman Island
1594-21124	March 9, 1974	0	69.32N	148.41W	15	166	Sagavanirktok
1594-21131	March 9, 1974	0	68.13N	150.33W	16	164	Chandler Lake
1594-21133	March 9, 1974	0	66.53N	152.13W	17	162	Bettles
1594-21140	March 9, 1974	0	65.33N	153.43W	18	161	Melozitna
1594-21142	March 9, 1974	0	64.13N	155.04W	19	159	Ruby
1594-21145	March 9, 1974	0	62.51N	156.18W	21	158	Iditarod
1594-21151	March 9, 1974	0	61.29N	157.27W	22	157	Sleetmute
1594-21154	March 9, 1974	0	60.06N	158.30W	23	155	Taylor Mts
1594-21160	March 9, 1974	0	58.43N	159.29W	24	154	Nushagak Bay
1594-21163	March 9, 1974	0	57.20N	160.24W	25	153	Bristol Bay
1594-21172	March 9, 1974	20	54.33N	162.04W	27	151	False Pass
1595-21180	March 10, 1974	2	70.50N	148.05W	14	168	Beechey Point
1595-21183	March 10, 1974	0	69.33N	150.10W	15	166	Sagavanirktok
1595-21185	March 10, 1974	0	68.11N	152.00W	17	164	Chandler Lake
1595-21192	March 10, 1974	0	66.54N	153.40W	18	162	Hughes
1595-21194	March 10, 1974	0	65.31N	155.10W	19	161	Melozitna
1595-21201	March 10, 1974	0	64.13N	156.31W	20	159	Nulato
1595-21203	March 10, 1974	0	62.52N	157.16W	21	158	Iditarod

1595-21210	March 10, 1974	0	61.30N	158.55W	22	157	Sleetmute
1595-21212	March 10, 1974	0	60.07N	159.58W	23	155	Taylor Mts.
1595-21215	March 10, 1974	0	58.44N	160.57W	24	154	Hagemeister Island
1595-21221	March 10, 1974	0	57.21N	161.52W	25	153	Bristol Bay
1596-21234	March 11, 1974	0	70.46N	149.29W	15	168	Beechey Point
1596-21241	March 11, 1974	5	69.29N	151.33W	16	166	Umiat
1596-21243	March 11, 1974	0	68.10N	153.24W	17	164	Chandler Lake
1596-21250	March 11, 1974	0	66.51N	155.03W	18	162	Hughes
1596-21252	March 11, 1974	0	65.31N	156.34W	19	161	Melozitna
1596-21255	March 11, 1974	0	64.10N	157.55W	20	159	Nulato
1596-21261	March 11, 1974	0	62.49N	159.11W	21	158	Holy Cross
1597-19493	March 12, 1974	0	60.05N	137.02W	24	155	North of Skagway
1597-19500	March 12, 1974	0	58.42N	138.01W	25	154	Mt. Fairweather
1597-21304	March 12, 1974	10	66.55N	156.31W	18	162	Shungnak
1597-21325	March 12, 1974	0	60.08N	162.50W	24	155	Bethel
1598-19551	March 13, 1974	0	60.07N	138.30W	24	155	Yakutat
1598-19554	March 13, 1974	0	58.44N	139.29W	25	154	Yakutat & ocean, land clear
1599-20003	March 14, 1974	0	61.29N	138.50W	24	156	East of McCarthy
1599-21414	March 14, 1974	5	68.15N	157.43W	18	164	Howard Pass
1599-21421	March 14, 1974	0	66.56N	159.23W	19	162	Shungnak
1599-21423	March 14, 1974	0	65.36N	160.53W	20	161	Candle
1599-21430	March 14, 1974	0	64.15N	162.14W	21	159	Solomon
1599-21432	March 14, 1974	0	62.53N	163.29W	23	158	Kwiguk
1599-21435	March 14, 1974	0	61.31N	164.38W	24	157	Marshall
1599-21441	March 14, 1974	0	60.08N	165.41W	25	155	Nunivak Island
1600-20055	March 15, 1974	0	62.52N	139.11W	23	158	East of Nabesna
1600-20062	March 15, 1974	0	61.30N	140.20W	24	156	East of McCarthy
1600-20064	March 15, 1974	0	60.07N	141.23W	25	155	Bering Glacier
1600-20071	March 15, 1974	5	58.45N	142.21W	26	154	Pacific Ocean
1600-21461	March 15, 1974	5	72.07N	152.54W	15	171	Arctic Ocean
1600-21464	March 15, 1974	5	70.51N	155.15W	16	168	Barrow
1600-21473	March 15, 1974	0	68.16N	159.11W	19	164	Misheguk Mt.
1600-21475	March 15, 1974	0	66.56N	160.51W	20	162	Selawik
1600-21482	March 15, 1974	5	65.36N	162.21W	21	161	Bendeleben
1600-21484	March 15, 1974	0	64.15N	163.42W	22	159	Solomon
1600-21491	March 15, 1974	0	62.54N	164.57W	23	158	Kwiguk
1601-20111	March 16, 1974	0	64.15N	139.17W	22	159	East of Eagle
1601-20113	March 16, 1974	0	62.53N	140.32W	23	158	East of Nabesna
1601-20120	March 16, 1974	0	61.31N	141.41W	24	157	McCarthy
1601-20122	March 16, 1974	0	60.09N	142.45W	25	155	Bering Glacier
1601-21515	March 16, 1974	10	72.07N	154.17W	16	171	Arctic Ocean
1601-21522	March 16, 1974	0	70.51N	156.38W	17	168	Barrow
1601-21524	March 16, 1974	0	69.34N	158.43W	18	166	Lookout Ridge
1601-21531	March 16, 1974	0	68.16N	160.36W	19	164	Misheguk Mt.
1601-21533	March 16, 1974	0	66.56N	162.16W	20	162	Noatak
1601-21540	March 16, 1974	0	65.36N	163.46W	21	161	Bendeleben
1601-21542	March 16, 1974	2	64.16N	165.08W	22	159	Nome
1602-21574	March 17, 1974	0	72.08N	155.50W	16	171	Barrow
1602-21580	March 17, 1974	0	70.52N	158.10W	17	168	Meade River
1602-21583	March 17, 1974	0	69.35N	160.15W	18	166	Utukok River
1602-21585	March 17, 1974	0	68.16N	162.05W	19	164	DeLong Mt.
1603-20223	March 18, 1974	25	64.15N	142.10W	23	159	Eagle
1603-20232	March 18, 1974	20	61.31N	144.34W	25	156	Valdez
1603-22032	March 18, 1974	0	72.07N	157.08W	16	171	Arctic Ocean
1603-22034	March 18, 1974	0	70.51N	159.34W	18	168	Wainwright
1603-22041	March 18, 1974	0	69.33N	161.39W	19	166	Utukok River
1603-22043	March 18, 1974	2	68.15N	163.29W	20	164	Delong Mt.
1604-20270	March 19, 1974	20	68.08N	139.14W	20	164	East of Table Mt.
1604-20275	March 19, 1974	20	65.28N	142.22W	22	161	Charley River
1604-22090	March 19, 1974	0	72.00N	158.50W	17	171	Barrow
1604-22093	March 19, 1974	0	70.44N	161.09W	18	168	Wainwright
1604-22095	March 19, 1974	0	69.27N	163.14W	19	166	Point Lay
1604-22102	March 19, 1974	0	68.09N	165.05W	20	164	Point Hope
1604-22104	March 19, 1974	15	66.49N	166.44W	21	162	Shishmaref
1605-22145	March 20, 1974	0	71.59N	160.14W	17	171	Arctic Ocean
1605-22151	March 20, 1974	0	70.43N	162.34W	18	168	Wainwright
1605-22154	March 20, 1974	0	69.26N	164.38W	20	166	Point Lay
1605-22160	March 20, 1974	10	68.07N	166.28W	21	164	Point Hope
1606-18592	March 21, 1974	0	54.27N	127.44W	32	150	East of Prince Rupert
1606-20380	March 21, 1974	0	69.25N	140.17W	20	166	Herschel Island
1606-22203	March 21, 1974	20	71.58N	161.42W	18	171	N. of Wainwright
1607-20432	March 22, 1974	20	70.43N	139.43W	19	168	Arctic Ocean
1607-20435	March 22, 1974	20	69.25N	141.45W	20	166	Demarcation Point
1607-20453	March 22, 1974	0	64.06N	148.02W	25	159	Fairbanks
1608-20491	March 23, 1974	5	70.43N	141.09W	20	168	Arctic Ocean
1608-20493	March 23, 1974	0	69.26N	143.12W	21	166	Barter Island
1609-20545	March 24, 1974	0	70.43N	142.38W	20	168	Barter Island
1609-20551	March 24, 1974	0	69.25N	144.40W	21	166	Mt. Michelson
1609-20554	March 24, 1974	1	68.07N	146.29W	22	164	Arctic
1609-20560	March 24, 1974	20	66.47N	148.07W	23	162	Beaver
1610-21003	March 25, 1974	0	70.43N	144.01W	20	168	Barter Island
1610-21010	March 25, 1974	0	69.25N	146.07W	22	166	Mt. Michelson

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1610-21012	March 25, 1974	0	68.07N	147.56W	23	164	Philip Smith Mtns..
1610-21015	March 25, 1974	0	66.47N	149.35W	24	162	Beaver
1610-21021	March 25, 1974	0	65.27N	151.04W	25	161	Tanana - Livengood
1610-21024	March 25, 1974	0	64.06N	152.24W	26	159	Kantishna River
1611-21064	March 26, 1974	5	69.25N	147.25W	22	166	Sagavanirktok
1611-21070	March 26, 1974	0	68.06N	149.24W	23	164	Philip Smith Mts.
1611-21073	March 26, 1974	0	66.47N	151.02W	24	162	Bettles
1611-21075	March 26, 1974	0	65.27N	152.31W	25	161	Tanana
1611-21082	March 26, 1974	5	64.06N	153.52W	26	159	Ruby
1611-21084	March 26, 1974	0	62.44N	155.05W	27	158	McGrath
1611-21091	March 26, 1974	0	61.22N	156.13W	29	156	Sleetmute
1611-21100	March 26, 1974	5	58.36N	158.13W	31	154	Naknek - Nushagak Bay
1612-21125	March 27, 1974	0	68.07N	150.47W	23	164	Chandler Lake
1612-21131	March 27, 1974	0	66.47N	152.25W	25	163	Bettles
1612-21134	March 27, 1974	0	65.26N	153.53W	26	161	Melozitna
1612-21140	March 27, 1974	0	64.06N	155.14W	27	159	Ruby
1612-21143	March 27, 1974	0	62.44N	156.28W	28	158	Iditarod
1612-21145	March 27, 1974	0	61.22N	157.37W	29	156	Sleetmute
1612-21152	March 27, 1974	10	59.59N	158.40W	30	155	Goodnews - Dillingham
1612-21154	March 27, 1974	20	58.36N	159.38W	31	154	Hagemeister Island - Nushagak Bay
1613-21174	March 28, 1974	10	70.43N	148.24W	22	169	Beechey Point
1613-21181	March 28, 1974	10	69.25N	150.28W	23	166	Umiat
1613-21183	March 28, 1974	0	68.06N	152.17W	24	164	Chandler Lake
1613-21190	March 28, 1974	10	66.46N	153.55W	25	163	Hughes
1613-21192	March 28, 1974	0	65.26N	155.24W	26	161	Melozitna
1613-21195	March 28, 1974	0	64.05N	156.44W	27	159	Nulato
1613-21201	March 28, 1974	5	62.44N	157.58W	28	158	Iditarod
1613-21204	March 28, 1974	5	61.22N	159.05W	29	156	Russian Mission
1614-21232	March 29, 1974	0	70.42N	149.50W	22	169	Beechey Point
1614-21235	March 29, 1974	0	69.25N	151.52W	23	166	Umiat
1614-21241	March 29, 1974	0	68.06N	153.42W	24	164	Killik River - Chandler Lake
1614-21244	March 29, 1974	0	66.47N	155.20W	25	163	Hughes
1614-21250	March 29, 1974	0	65.26N	156.48W	26	161	Kateel River - Melozitna
1615-21284	March 30, 1974	0	71.58N	149.00W	21	171	Arctic Ocean
1615-21291	March 30, 1974	20	70.42N	151.18W	22	169	Harrison Bay
1615-21293	March 30, 1974	0	69.24N	153.21W	24	166	Ikpikpuk River
1615-21300	March 30, 1974	0	68.06N	155.10W	25	164	Killik River
1615-21302	March 30, 1974	0	66.46N	156.48W	26	163	Shungnak
1615-21305	March 30, 1974	0	65.26N	158.16W	27	161	Kateel River
1616-21342	March 31, 1974	0	71.50N	150.25W	22	171	Arctic Ocean
1616-21345	March 31, 1974	10	70.41N	152.43W	23	169	Harrison Bay
1616-21351	March 31, 1974	15	69.24N	154.45W	24	167	Ikpikpuk River
1616-21354	March 31, 1974	0	68.06N	156.34W	25	164	Howard Pass
1616-21360	March 31, 1974	0	66.46N	158.12W	26	163	Shungnak
1616-21363	March 31, 1974	0	65.26N	159.40W	27	161	Candle
1616-21365	March 31, 1974	0	64.05N	161.01W	28	159	Norton Bay
1616-21372	March 31, 1974	15	62.44N	162.14W	29	158	Holy Cross
1616-21374	March 31, 1974	15	61.22N	163.23W	31	156	Marshall
1617-19595	April 1, 1974	0	62.44N	137.54W	30	158	East of Nabesna
1617-20001	April 1, 1974	10	61.23N	139.02W	31	156	East of McCarthy
1617-20004	April 1, 1974	20	60.00N	140.05W	32	155	Mt. St. Elias - Yakutat
1617-20010	April 1, 1974	0	58.37N	141.03W	33	153	Pacific Ocean
1617-21401	April 1, 1974	0	72.00N	151.47W	22	171	N. of Harrison Bay, Arctic Ocean
1617-21403	April 1, 1974	0	70.44N	154.05W	23	169	Teshekpuk
1617-21410	April 1, 1974	0	69.27N	156.08W	24	167	Lookout Ridge
1617-21412	April 1, 1974	0	68.09N	157.58W	25	165	Howard Pass
1617-21415	April 1, 1974	0	66.50N	159.36W	27	163	Shungnak
1617-21421	April 1, 1974	0	65.29N	161.06W	28	161	Candle
1617-21424	April 1, 1974	0	64.09N	162.26W	29	159	Norton Bay
1617-21430	April 1, 1974	0	62.47N	163.40W	30	158	Kwiguk
1618-20053	April 2, 1974	0	62.44N	139.19W	30	158	East of Nabesna
1618-20055	April 2, 1974	0	61.21N	140.26W	31	156	McCarthy
1618-21455	April 2, 1974	0	71.57N	153.16W	22	171	N. of Teshekpuk
1618-21462	April 2, 1974	0	70.41N	155.34W	24	169	Barrow - Teshekpuk
1618-21464	April 2, 1974	0	69.24N	157.37W	25	167	Lookout Ridge
1618-21471	April 2, 1974	0	68.06N	159.26W	26	165	Misheguk Mtn.
1618-21473	April 2, 1974	0	66.46N	161.05W	27	163	Noatak
1618-21480	April 2, 1974	0	65.26N	162.34W	28	161	Bendeleben
1618-21482	April 2, 1974	0	64.05N	163.54W	29	159	Solomon
1618-21485	April 2, 1974	0	62.44N	165.06W	30	158	Kwiguk
1619-20105	April 3, 1974	0	64.06N	139.34W	30	159	East of Eagle
1619-20111	April 3, 1974	0	62.44N	140.47W	31	158	East of Nabesna
1619-20114	April 3, 1974	0	61.22N	141.54W	32	156	McCarthy
1619-21513	April 3, 1974	0	71.57N	154.45W	23	171	Barrow
1619-21520	April 3, 1974	0	70.40N	157.03W	24	169	Meade River
1619-21522	April 3, 1974	0	69.23N	159.05W	25	167	Utukok River
1619-21525	April 3, 1974	0	68.05N	160.51W	26	165	Misheguk Mtn.
1619-21531	April 3, 1974	0	66.45N	162.37W	27	163	Kotzebue
1619-21531	April 3, 1974	0	65.25N	161.01W	28	161	Bendeleben
1620-20161	April 4, 1974	0	65.26N	139.40W	29	161	East of Charley River
1620-20163	April 4, 1974	0	64.05N	141.01W	30	159	Eagle

1620-20170	April 4, 1974	0	62.43N	142.14W	31	158	Nabesna
1620-21572	April 4, 1974	20	71.59N	156.08W	23	171	Arctic Ocean
1620-21574	April 4, 1974	20	70.43N	158.27W	24	169	Barrow - Meade River
1620-21581	April 4, 1974	20	69.26N	160.29W	25	167	Utukok River
1621-20212	April 5, 1974	0	66.47N	139.32W	28	163	East of Black River
1621-20215	April 5, 1974	0	65.27N	141.01W	29	161	Charley River
1621-20221	April 5, 1974	20	64.06N	142.22W	30	159	Eagle
1621-22030	April 5, 1974	0	71.58N	157.35W	24	171	Barrow
1621-22032	April 5, 1974	10	70.42N	159.53W	25	169	Meade River
1621-22035	April 5, 1974	10	69.25N	161.55W	26	167	Utukok River
1621-22050	April 5, 1974	20	65.27N	166.50W	29	161	Teller
1622-22100	April 6, 1974	5	68.06N	165.10W	27	165	Point Hope
1622-20264	April 6, 1974	0	68.06N	139.22W	27	165	East of Table Mtn.
1623-20320	April 7, 1974	0	69.25N	139.03W	27	167	Herschel Island
1623-22154	April 7, 1974	10	68.05N	166.41W	28	165	Point Hope
1623-22160	April 7, 1974	20	66.46N	168.19W	29	163	Bering Straits
1624-20374	April 8, 1974	0	69.23N	140.31W	27	167	Herschel Island
1625-20430	April 9, 1974	0	70.40	139.56W	26	169	Arctic Ocean
1625-20432	April 9, 1974	0	69.23N	141.57W	27	167	Demarcation Point
1625-20435	April 9, 1974	0	68.05N	143.46W	29	165	Table Mt.
1625-22262	April 9, 1974	0	70.39N	165.45W	26	169	Arctic Ocean
1625-22264	April 9, 1974	0	69.22N	167.46W	27	167	Chukchi Sea
1625-22271	April 9, 1974	0	68.03N	169.35W	29	165	Chukchi Sea
1626-20484	April 10, 1974	0	70.40N	141.22W	27	169	Barter Island
1626-20491	April 10, 1974	0	69.22N	143.24W	28	167	Demarcation Point
1626-20500	April 10, 1974	20	66.44N	146.50W	30	163	Fort Yukon
1626-20502	April 10, 1974	30	65.23N	148.17W	31	161	Fairbanks - Livengood
1626-20505	April 10, 1974	25	64.02N	149.37W	32	159	Fairbanks - Healy
1627-20543	April 11, 1974	0	70.38N	142.49W	27	169	Barter Island
1627-20545	April 11, 1974	0	69.21N	144.50W	28	167	Mt. Michelson
1627-20552	April 11, 1974	0	68.03N	146.39W	29	165	Arctic
1628-21003	April 12, 1974	2	69.21N	146.22W	29	167	Mt. Michelson
1628-21010	April 12, 1974	0	68.03N	148.10W	30	165	Philip Smith Mtns.
1628-21012	April 12, 1974	0	66.44N	149.48W	31	163	Beaver
1628-21033	April 12, 1974	25	59.56N	155.57W	36	154	Illiamna
1631-21174	April 15, 1974	10	69.23N	150.37W	30	167	Umiat
1631-21181	April 15, 1974	25	68.04N	152.26W	31	165	Chandler Lake
1632-21250	April 16, 1974	10	64.03N	158.16W	34	159	Nulato
1632-21253	April 16, 1974	25	62.41N	159.28W	36	158	Iditarod
1634-19540	April 18, 1974	5	61.22N	137.37W	37	156	North of Skagway
1634-21340	April 18, 1974	0	71.58N	150.32W	28	172	Arctic Ocean
1634-21342	April 18, 1974	15	70.42N	152.50W	30	169	Harrison Bay
1635-19592	April 19, 1974	0	62.43N	137.59W	37	158	East of Nabesna
1635-19595	April 19, 1974	0	61.21N	139.07W	38	156	East of McCarthy
1637-20111	April 21, 1974	10	61.23N	141.53W	38	156	McCarthy
1638-21572	April 22, 1974	5	70.41N	158.29W	31	170	Meade River
1638-21574	April 22, 1974	0	69.24N	160.31W	32	167	Utukok River
1638-21581	April 22, 1974	0	68.05N	162.21W	33	165	DeLong Mt.
1638-21583	April 22, 1974	0	66.46N	163.58W	34	163	Cape Espenberg
1639-22023	April 23, 1974	0	71.56N	157.45W	30	172	N. Barrow
1639-22030	April 23, 1974	0	70.40N	160.02W	31	170	Wainwright
1639-22032	April 23, 1974	0	69.23N	162.05W	32	167	Point Lay
1641-20320	April 25, 1974	0	68.02N	140.56W	34	165	Table Mtn.
1641-20322	April 25, 1974	0	66.43N	142.33W	35	163	Black River
1641-20325	April 25, 1974	10	65.23N	144.02W	36	161	Circle
1641-20331	April 25, 1974	5	64.02N	145.22W	38	159	Big Delta
1641-20334	April 25, 1974	20	62.40N	146.36W	39	157	Gulkana
1641-20340	April 25, 1974	20	61.18N	147.44W	40	156	Anchorage - Valdez
1642-20381	April 26, 1974	0	66.46N	143.59W	36	163	Fort Yukon
1642-20383	April 26, 1974	0	65.25N	145.27W	37	161	Circle
1642-20390	April 26, 1974	0	64.05N	146.47W	38	159	Fairbanks - Delta
1642-20392	April 26, 1974	0	62.43N	148.01W	39	157	Talkeetna Mt.
1642-20395	April 26, 1974	0	61.21N	149.09W	40	156	Anchorage
1643-20432	April 27, 1974	0	68.04N	143.49W	35	165	Table Mt.
1643-20435	April 27, 1974	0	66.45N	145.27W	36	163	Fort Yukon
1643-20441	April 27, 1974	0	65.24N	146.54W	37	161	Fairbanks
1643-22255	April 27, 1974	0	70.42N	165.43W	33	170	Arctic Ocean
1643-22261	April 27, 1974	0	69.25N	167.44W	34	167	Arctic Ocean
1643-22264	April 27, 1974	0	68.06N	169.34W	35	165	Chukchi Sea
1646-20594	April 30, 1974	15	70.40N	144.17W	34	170	Barter Island
1646-21001	April 30, 1974	0	69.22N	146.18W	35	167	Mt. Michelson
1646-21003	April 30, 1974	0	68.03N	148.07W	36	167	Philip Smith Mts.
1646-21010	April 30, 1974	0	66.44N	149.44W	37	163	Beaver
1646-21012	April 30, 1974	0	65.24N	151.12W	38	161	Tanana
1646-21015	April 30, 1974	0	64.03N	152.32W	39	159	Kantishna River
1646-21021	April 30, 1974	0	62.42N	153.46W	40	157	Talkeetna
1646-21024	April 30, 1974	0	61.19N	154.53W	41	155	Lime Hills
1647-21064	May 1, 1974	10	66.47N	151.13W	37	163	Bettles
1647-21070	May 1, 1974	10	65.27N	152.41W	38	161	Tanana
1647-21073	May 1, 1974	5	64.06N	154.01W	39	159	Ruby
1647-21075	May 1, 1974	0	62.44N	155.14W	40	157	McGrath
1647-21082	May 1, 1974	0	61.22N	156.21W	42	155	Lime Hills
1649-21171	May 3, 1974	0	69.21N	150.40W	36	167	Umiat
1649-21180	May 3, 1974	5	66.46N	154.04W	38	163	Hughes
1649-21183	May 3, 1974	0	65.25N	155.32W	39	161	Melozitna
1649-21185	May 3, 1974	0	64.04N	156.52W	40	159	Kulato

1649-21197	May 3, 1974	0	62.43N	158.06W	41	157	Iditarod	
1649-21191	May 3, 1974	0	61.21N	159.14W	42	155	Russian Mission	
1650-21223	May 4, 1974	10	70.44N	149.58W	35	170	Beechey Point	
1650-21230	May 4, 1974	10	69.27N	152.00W	36	167	Umiat	
1650-21232	May 4, 1974	0	68.08N	153.48W	37	165	Killik River	
1650-21235	May 4, 1974	0	66.49N	155.25W	38	163	Survey Pass	
1650-21241	May 4, 1974	0	65.29N	156.54W	39	161	Kateel River	
1650-21244	May 4, 1974	0	64.08N	158.15W	40	159	Nulato	
1650-21250	May 4, 1974	0	62.47N	159.29W	41	157	Holy Cross	
1650-21253	May 4, 1974	0	61.25N	160.37W	42	155	Russian Mission	
1650-21255	May 4, 1974	0	60.02N	161.39W	43	154	Bethel	
1651-21275	May 5, 1974	0	71.58N	149.05W	34	172	Arctic Ocean	
1651-21281	May 5, 1974	40	70.43N	151.23W	35	170	Harrison Bay	
1651-21284	May 5, 1974	40	69.25N	153.25W	36	167	Ikpikpuk River	
1651-21290	May 5, 1974	10	68.07N	155.14W	37	165	Killik River	
1651-21293	May 5, 1974	0	66.48N	156.51W	38	163	Shungnak	
1651-21295	May 5, 1974	0	65.28N	158.19W	39	161	Kateel River	
1651-21302	May 5, 1974	0	64.06N	159.39W	41	159	Norton Bay	
1651-21304	May 5, 1974	0	62.45N	160.53W	42	157	Holy Cross	
1651-21311	May 5, 1974	0	61.23N	162.00W	43	155	Russian Mission	
1652-21345	May 6, 1974	20	68.09N	156.39W	37	165	Howard Pass	
1652-21351	May 6, 1974	10	66.50N	158.18W	39	163	Shungnak	
1652-21354	May 6, 1974	10	65.29N	159.47W	40	161	Candle	
1652-21360	May 6, 1974	0	64.08N	161.07W	41	159	Norton Bay	
1652-21363	May 6, 1974	1	62.47N	162.20W	42	157	Kwiguk	
1652-21365	May 6, 1974	1	61.25N	163.27W	43	155	Marshall	
1652-21372	May 6, 1974	5	60.03N	164.29W	44	153	Baird Inlet	
1653-21394	May 7, 1974	0	70.45N	154.18W	36	170	Teshekpuk	
1653-21400	May 7, 1974	0	69.28N	156.20W	37	167	Lookout Ridge	
1653-21403	May 7, 1974	10	68.09N	158.10W	38	165	Howard Pass	
1653-21405	May 7, 1974	10	66.50N	159.47W	39	163	Selawik	
1653-21414	May 7, 1974	10	64.09N	162.37W	41	159	Solomon	
1653-21421	May 7, 1974	0	62.47N	163.51W	42	157	Kwiguk	
1654-21450	May 8, 1974	0	71.59N	153.26W	35	172	Arctic Ocean	
1654-21452	May 8, 1974	10	70.43N	155.44W	36	170	Barrow	
1654-21473	May 8, 1974	5	64.07N	164.02W	41	159	Solomon	
1655-21504	May 9, 1974	10	72.01N	154.50W	35	172	Arctic Ocean	
1655-21515	May 9, 1974	0	68.10N	160.57W	38	165	Misheguk Mountain	
1655-21522	May 9, 1974	10	66.50N	162.35W	39	163	Kotzebue - Selawik	
1656-20151	May 10, 1974	10	65.29N	139.41W	41	161	Charley River	
1656-21574	May 10, 1974	0	68.08N	162.28W	39	165	DeLong Mts.	
1661-20425	May 15, 1974	0	68.07N	143.47W	40	165.	Table Mtn	
1667-21180	May 21, 1974	20	65.33N	155.29W	43	160	Melozitna	
1667-21200	May 21, 1974	5	58.42N	161.10W	48	150	Hagemeister Island	
1669-21292	May 23, 1974	0	65.34N	158.16W	44	160	Kateel River	
1669-21310	May 23, 1974	0	60.08N	163.01W	48	152	Baird Inlet	
1670-21344	May 24, 1974	0	66.56N	158.13W	43	162	Ambler River	
1670-21360	May 24, 1974	0	62.53N	162.17W	46	156	Kwiguk	
1670-21362	May 24, 1974	0	61.32N	163.25W	47	154	Marshall	
1671-21400	May 25, 1974	0	68.14N	158.03W	42	164	Howard Pass	
1671-21405	May 25, 1974	0	65.34N	161.10W	44	160	Candle	
1671-21420	May 25, 1974	0	61.29N	164.56W	47	154	Hooper Bay	
1672-21454	May 26, 1974	0	68.15N	159.29W	42	164	Misheguk Mtn.	
1672-21461	May 26, 1974	0	66.55N	161.08W	43	162	Selawik	
1672-21463	May 26, 1974	0	65.35N	162.37W	44	160	Bendeleben	
1672-21470	May 26, 1974	0	64.16N	163.57W	45	158	Solomon	
1672-21472	May 26, 1974	0	62.54N	165.11W	46	156	Black - Kwiguk	
1672-21475	May 26, 1974	0	61.32N	166.19W	47	154	Hooper Bay	
1673-21512	May 27, 1974	0	68.17N	160.57W	41	164	Misheguk Mtn.	
1673-21515	May 27, 1974	0	66.57N	162.35W	43	162	Kotzebue - Baldwin Penn.	
1673-21521	May 27, 1974	0	65.38N	164.03W	44	160	Bendeleben	
1674-20132	May 28, 1974	0	69.34N	134.43W	41	167	MacKenzie Bay	
1674-21442	May 28, 1974	10	73.25N	153.27W	38	175	Beaufort Sea	
1674-21561	May 28, 1974	20	70.55N	158.26W	40	169	Barrow	
1674-21570	May 28, 1974	0	68.19N	162.20W	42	164	DeLong Mtns.	
1674-21573	May 28, 1974	0	66.59N	163.58W	43	162	Kotzebue	
1675-20182	May 29, 1974	10	72.05N	131.48W	39	172	Beaufort Sea	
1675-20184	May 29, 1974	0	70.50N	134.05W	40	169	Beaufort Sea	
1675-20191	May 29, 1974	0	69.32N	136.10W	41	166	MacKenzie Bay	
1675-22031	May 29, 1974	0	66.53N	165.29W	44	162	Shishmaref	
1675-22034	May 29, 1974	15	65.33N	166.57W	45	159	Teller	
1676-20263	May 30, 1974	5	64.14N	143.54W	46	157	Delta - Eagle	
1676-22090	May 30, 1974	0	66.55N	166.55W	44	162	Shishmaref	
1676-22092	May 30, 1974	0	65.34N	168.21W	45	159	Teller	
1676-22095	May 30, 1974	0	64.13N	169.46W	46	157	St. Lawrence Is.	
1676-22101	May 30, 1974	0	62.51N	170.59W	47	155	St. Lawrence Is.	
1676-22104	May 30, 1974	0	61.29N	172.06W	48	153	Bering Sea	
1676-22110	May 30, 1974	2	60.07N	173.09W	49	151	St Matthew	
1677-22141	May 31, 1974	0	68.15N	166.36W	43	164	Point Hope	
1677-22144	May 31, 1974	0	66.55N	168.15W	44	162	Chukchi Sea	ORIGINAL PAGE IS
1677-22153	May 31, 1974	1	64.15N	171.05W	46	157	St. Lawrence Is.	OF POOR QUALITY
1677-22150	May 31, 1974	0	65.35N	169.44W	45	159	Bering Straits	
1677-22155	May 31, 1974	10	62.53N	172.20W	47	155	St. Lawrence Is.	

1678-22211	June 1, 1974	0	64.16N	172.31W	46	157	Siberia	
1678-22213	June 1, 1974	5	62.55N	173.45W	47	155	St. Lawrence Island	
1678-22220	June 1, 1974	5	61.33N	174.53W	48	153	Bering Sea	
1679-20443	June 2, 1974	30	61.29N	150.34W	48	153	Tyonek	
1680-20462	June 3, 1974	0	73.23N	136.16W	39	175	Beaufort Sea	
1680-20465	June 3, 1974	0	72.09N	138.55W	40	172	Beaufort Sea	
1680-20501	June 3, 1974	30	61.32N	152.00W	48	153	Tyonek	
1680-20510	June 3, 1974	0	58.46N	154.01W	50	149	Mt. Katmai	
1680-20512	June 3, 1974	0	57.23N	154.55W	51	147	Karluk	
1686-21224	June 9, 1974	0	66.59N	155.20W	45	161	Hughes	
1686-21242	June 9, 1974	0	61.34N	160.34W	49	152	Russian Mission	
1686-21245	June 9, 1974	0	60.11N	161.36W	50	150	Bethel	
1686-21251	June 9, 1974	0	58.48N	162.35W	51	148	Hagemeister Island	
1686-21254	June 9, 1974	10	57.24N	163.28W	52	146	Bristol Bay	
1687-21312	June 10, 1974	20	57.23N	164.57W	52	146	Bristol Bay	
1687-21315	June 10, 1974	10	55.59N	165.48W	53.	144	Bering Sea	
1687-21321	June 10, 1974	10	54.35N	166.36W	54	141	Unimak Island	
1688-21361	June 11, 1974	20	60.10N	164.26W	50	150	Kuskokwim Bay	
1692-20143	June 15, 1974	5	64.18N	140.54W	47	156	Eagle	
1692-20150	June 15, 1974	2	62.56N	142.08W	48	154	Nabesna	C
1692-20152	June 15, 1974	20	61.34N	143.17W	49	152	McCarthy	C
1692-22002	June 15, 1974	15	56.02N	172.56W	53	143	Bering Sea	
1693-22060	June 16, 1974	20	56.01N	174.25W	53	143	Bering Sea	
1694-22071	June 17, 1974	0	70.53N	161.16W	42	168	Barrow	
1694-22073	June 17, 1974	0	69.36N	163.20W	43	165	Point Lay	
1694-22080	June 17, 1974	0	68.17N	165.11W	44	163	Point Hope	
1694-22082	June 17, 1974	0	66.58N	166.50W	45	160	Shishmaref	
1694-22085	June 17, 1974	0	65.37N	168.20W	46	158	Teller	
1694-22091	June 17, 1974	0	64.16N	169.41W	47	156	St. Lawrence Island	
1694-22094	June 17, 1974	20	62.54N	170.55W	48	153	St. Lawrence Island	
1694-22103	June 17, 1974	5	60.09N	173.04W	50	149	St. Matthews	
1695-22134	June 18, 1975	10	68.17N	166.37W	44	163	Point Hope	
1697-20421	June 20, 1974	2	66.57N	145.19W	45	160	Fort Yukon	
1697-20424	June 20, 1974	1	65.36N	146.48W	46	158	Circle	
1698-20464	June 21, 1974	0	70.54N	141.08W	42	168	Beaufort Sea	
1698-20491	June 21, 1974	20	62.54N	150.47W	48	153	Talkeetna	D + C
1698-20493	June 21, 1974	2	61.32N	151.54W	49	151	Tyonek	D
1698-22300	June 21, 1974	5	70.52N	167.02W	42	167	Chukchi Sea	
1698-22302	June 21, 1974	0	69.35N	169.06W	43	165	Chukchi Sea	
1698-22305	June 21, 1974	0	68.17N	170.57W	44	162	Chukchi Sea	
1699-20522	June 22, 1974	0	70.54N	142.42W	42	167	Beaufort Sea	
1699-20570	June 22, 1974	10	55.59N	157.10W	53	142	Sutwik Island	
1699-22360	June 22, 1974	10	69.37N	170.37W	43	165	Chukchi Sea	
1700-20592	June 23, 1974	30	66.55N	149.40W	45	160	Beaver	
1702-21084	June 25, 1974	0	73.23N	141.58W	39	173	Beaufort Sea	
1702-21090	June 25, 1974	0	72.09N	144.37W	41	170	Beaufort Sea	
1702-21093	June 25, 1974	0	70.53N	146.58W	42	167	Beechey Point	C + D
1702-21095	June 25, 1974	5	69.36N	149.03W	43	164	Sagavanirktok	
1703-21151	June 26, 1974	0	70.54N	148.17W	42	167	Prudhoe - Beechey Point	
1706-19522	June 29, 1974	50	60.09N	138.39W	50	148	Yakutat	
1706-21322	June 29, 1974	0	70.54N	152.42W	42	167	Harrison Bay	
1706-21342	June 29, 1974	0	64.16N	161.05W	47	155	Norton Bay	D + C
1706-21345	June 29, 1974	0	62.54N	162.19W	48	153	St. Michael	
1706-21351	June 29, 1974	0	61.31N	163.27W	49	150	Marshall	
1706-21354	June 29, 1974	10	60.08N	164.29W	50	148	Nunivak Island	
1707-21391	June 30, 1974	0	66.59N	159.43W	45	159	Baird Mts.	C
1707-21400	June 30, 1974	20	64.17N	162.34W	47	155	Solomon	
1707-21403	June 30, 1974	15	62.55N	163.47W	48	152	St. Michael	
1708-20035	July 1, 1974	0	60.10N	141.30W	50	148	Icy Bay	
1708-20041	July 1, 1974	20	58.48N	142.29W	51	146	Gulf of Alaska	
1709-20090	July 2, 1974	5	61.32N	141.57W	49	150	McCarthy & East	D + C
1709-20093	July 2, 1974	30	60.09N	142.59W	50	148	Bering Glacier	
1709-21504	July 2, 1974	0	67.02N	162.27W	45	159	Baldwin Penn.	C
1709-21510	July 2, 1974	5	65.41N	163.58W	46	157	Bendeleben	D + C
1709-21513	July 2, 1974	0	64.20N	165.19W	47	155	Nome	C
1709-21515	July 2, 1974	15	62.58N	166.35W	48	152	Black	
1710-21551	July 3, 1974	5	70.53N	158.28W	41	167	Barrow	
1710-21553	July 3, 1974	0	69.35N	160.31W	42	164	Utukok River	C
1710-21562	July 3, 1974	2	66.57N	163.59W	44	159	Shishmaref	
1710-21565	July 3, 1974	0	65.36N	165.29W	46	157	Teller - Bendeleben	D + C
1710-21571	July 3, 1974	0	64.15N	166.51W	47	154	Nome	
1710-21574	July 3, 1974	0	62.54N	168.05W	48	152	Tip of St. Lawrence Is.	
1710-21580	July 3, 1974	0	61.32N	169.13W	48	150	Bering Sea	
1710-21583	July 3, 1974	0	60.09N	170.15W	49	148	Bering Sea	
1710-21585	July 3, 1974	0	58.45N	171.12W	50	146	Bering Sea	
1711-22014	July 4, 1974	0	68.17N	163.50W	43	161	DeLong Mts	
1711-22020	July 4, 1974	5	66.58N	165.29W	44	159	Shishmaref	
1711-22023	July 4, 1974	0	65.37N	166.58W	45	157	Teller	D + C
1711-22025	July 4, 1974	0	64.15N	168.19W	46	154	Bering Sea	
1711-22032	July 4, 1974	0	62.53N	169.33W	47	152	St. Lawrence Island	
1713-20281	July 6, 1974	0	73.24N	131.53W	39	173	Beaufort Sea	
1713-22121	July 6, 1974	5	70.52N	162.41W	41	167	Wainwright	
1713-22144	July 6, 1974	2	62.53N	172.21W	47	152	St. Lawrence Island	
1713-22151	July 6, 1974	5	61.30N	173.29W	48	150	Bering Sea	
1714-22182	July 7, 1974	5	69.35N	166.18W	42	164	Tip of Point Hope	
1714-22193	July 7, 1974	15	65.36N	171.13W	45	157	Siberia	
1715-22254	July 8, 1974	20	64.14N	173.57W	46	154	Chukotsk Penn.	
1717-20562	July 10, 1974	5	55.55N	157.12W	51	142	Sutwik Is.	
1717-22353	July 10, 1974	10	69.34N	170.42W	42	164	Chukchi Sea	
1719-21025	July 12, 1974	0	72.05N	143.20W	39	169	Beaufort Sea	
1719-21031	July 12, 1974	0	70.49N	145.39W	40	166	Flaxman Island	
1720-21080	July 13, 1974	30	73.20N	142.10W	38	172	Beaufort Sea	

1722-21213	July 15, 1974	10	66.51N	155.26W	43	158	Walker Lake	C
1720-21103	July 13, 1974	2	65.33N	154.06W	44	156	Melozitna	
1720-22512	July 13, 1974	0	73.21N	167.58W	38	172	Chukchi Sea	
1720-22514	July 13, 1974	0	72.07N	170.36W	39	169	Chukchi Sea	
1721-21141	July 14, 1974	0	72.06N	146.07W	39	169	Beaufort Sea	
1721-21143	July 14, 1974	0	70.50N	148.27W	40	166	Beechey Point	
1721-21150	July 14, 1974	0	69.33N	150.30W	41	163	Umiat	
1722-21195	July 15, 1974	1	72.04N	147.39W	39	169	Beaufort Sea	
1722-21202	July 15, 1974	0	70.48N	149.58W	40	166	Beechey Point	
1722-21204	July 15, 1974	0	69.30N	152.02W	41	163	Umiat	
1722-21211	July 15, 1974	0	68 11N	153 50W	42	161	Chandler Lake	C
1723-21251	July 16, 1974	0	73.19N	146.28W	37	172	Beaufort SEa	
1723-21253	July 16, 1974	0	72.04N	149.06W	39	169	Beaufort Sea	
1723-21260	July 16, 1974	0	70.48N	151.25W	40	166	Harrison Bay	
1723-21262	July 16, 1974	1	69.31N	153.28W	41	163	Ikpikpuk River	D + C
1727-21485	July 20, 1974	30	70.48N	157.07W	39	166	Pt. Barrow	
1728-21540	July 21, 1974	10	72.05N	156.14W	38	169	Barrow	
1730-22064	July 23, 1974	15	68.12N	165.16W	40	161	Chukchi Sea	
1730-22080	July 23, 1974	5	64.10N	169.46W	44	154	St. Lawrence Island	
1730-22082	July 23, 1974	10	62.48N	171.00W	45	152	St. Lawrence Island	
1732-20331	July 25, 1974	15	73.16N	133.31W	36	172	Beaufort Sea	
1732-20334	July 25, 1974	0	72.01N	136.10W	37	169	Beaufort Sea	
1733-20433	July 26, 1974	30	58.37N	152.37W	47	146	Afognak	
1734-20464	July 27, 1974	30	66.49N	146.47W	41	159	Fort Yukon	
1734-20471	July 27, 1974	10	65.28N	148.17W	42	156	Fairbanks - Livengood	D + C
1734-20473	July 27, 1974	30	64.07N	149.38W	43	154	Healy	D + C
1734-20480	July 27, 1974	30	62.45N	150.51W	44	152	Mt. McKinley	D + C
1734-20482	July 27, 1974	5	61.23N	151.59W	45	150	Tyonek	D + C
1734-20491	July 27, 1974	0	58.37N	153.59W	47	146	Mt. Katmai	C
1734-20494	July 27, 1974	0	57.14N	154.52W	48	145	Kodiak	C
1734-20500	July 27, 1974	10	55.50N	155.43W	48	143	Trinity Island	
1737-21064	July 30, 1974	15	57.14N	159.14W	47	145	Bristol Bay	
1738-19284	July 31, 1974	30	58.38N	133.54W	46	147	Taku River	
1738-19291	July 31, 1974	20	57.14N	134.47W	47	145	Sitka	
1738-22511	July 31, 1974	0	72.01N	170.38W	35	169	Chukchi Sea	
1740-21191	August 2, 1974	10	71.59N	147.47W	35	169	Beaufort Sea	
1740-21194	August 2, 1974	2	70.42N	150.04W	36	166	Harrison Bay	
1742-21315	August 4, 1974	20	68.07N	156.44W	38	161	Howard Pass	C
1742-21331	August 4, 1974	15	64.05N	161.09W	41	155	Norton Bay	
1742-21333	August 4, 1974	15	62.53N	162.23W	42	153	Kwiguk	
1743-21374	August 5, 1974	0	68.07N	158.10W	37	161	Howard Pass	C
1743-21385	August 5, 1974	5	64.05N	162.35W	41	155	Solomon	
1744-21432	August 6, 1974	1	68.07N	159.32W	37	161	Misheguk Mtn.	
1744-21434	August 6, 1974	20	66.48N	161.09W	38	159	Selawik	D + C
1744-21443	August 6, 1974	20	64.06N	163.58W	40	155	Solomon	
1745-20052	August 7, 1974	3	69.36N	133.24W	36	164	MacKenzie Bay	
1734-20485	July 27, 1974	5	59.[illegible]N	153.[illegible]W	46	148	Lake Clark	
1745-20072	August 7, 1974	40	62.44N	140.52W	41	153	Nabesna and East	C
1745-21472	August 7, 1974	10	73.14N	152.20W	33	172	Beaufort Sea	
1747-22011	August 9, 1974	30	65.25N	166.58W	38	157	Teller	
1749-22115	August 11, 1974	20	68.05N	166.52W	36	162	Point Hope	
1752-20481	August 14, 1974	15	59.56N	153.07W	41	150	Illiamna	
1752-20483	August 14, 1974	10	58.32N	154.04W	42	149	Mt. Katmai	
1753-20535	August 15, 1974	0	59.57N	154.33W	41	151	Illiamna	C
1759-21280	August 21, 1974	30	59.57N	163.09W	39	157	Kuskokwim Bay	
1760-21302	August 22, 1974	0	70.40N	153.01W	30	167	Teshekpuk	C
1760-21305	August 22, 1974	5	69.21N	155.03W	31	165	Ikpikpuk River	C
1760-21323	August 22, 1974	0	64.03N	161.13W	36	157	Norton Sound	
1760-21325	August 22, 1974	15	62.41N	162.26W	37	155	Kwiguk	
1764-20102	August 26, 1974	0	69.19N	134.58W	30	165	MacKenzie Bay	
1768-20342	August 30, 1974	1	65.22N	145.35W	32	160	Circle	
1768-20345	August 30, 1974	2	64.00N	146.54W	33	158	Fairbanks - Delta	
1768-20351	August 30, 1974	20	62.38N	148.06W	34	156	Talkeetna Mts	C
1769-20403	August 31, 1974	25	63.59N	148.18W	33	158	Healy	C
1770-20450	September 1, 1974	5	68.00N	145.23W	29	164	Arctic	
1770-20452	September 1, 1974	40	66.41N	147.00W	30	162	Fort Yukon	
1771-20504	September 2, 1974	40	68.00N	146.45W	29	164	Arctic	
1771-20510	September 2, 1974	25	66.39N	148.22W	25	162	Beaver	
1771-20513	September 2, 1974	0	65.19N	149.49W	31	160	Livengood	D + C
1771-20515	September 2, 1974	20	63.58N	151.09W	32	158	Mt. McKinley	D + C
1771-20540	September 2, 1974	30	57.06N	156.20W	37	151	Ugashik	C
1772-20571	September 3, 1974	5	65.19N	151.16W	31	160	Tanana	
1772-20574	September 3, 1974	0	63.58N	152.35W	32	159	Kantishna River - Mt. McKinley	C
1772-20580	September 3, 1974	0	62.36N	153.47W	33	157	McGrath	C
1772-20583	September 3, 1974	0	61.14N	154.54W	34	155	Lake Clark, Lime Hills	C
1772-20585	September 3, 1974	2	59.52N	155.56W	35	154	Illiamna	C
1772-20592	September 3, 1974	5	58.28N	156.54W	36	152	Nahnek	C
1773-21011	September 4, 1974	0	70.37N	145.49W	26	168	Flaxman Island	
1773-21014	September 4, 1974	0	69.19N	147.49W	27	166	Mt. Michelson	
1773-21020	September 4, 1974	0	68.01N	149.36W	28	164	Philip Smith Mtn	C
1773-21025	September 4, 1974	0	65.22N	152.40W	30	160	Tanana	
1773-21034	September 4, 1974	0	62.39N	155.12W	32	157	McGrath	
1773-21041	September 4, 1974	0	61.17N	156.19W	33	156	Sleetmute - Lime Hills	
1773-21043	September 4, 1974	0	59.54N	157.20W	34	154	Dillingham	C
1774-21065	September 5, 1974	10	70.36N	147.16W	25	169	Beechey Point	
1774-21072	September 5, 1974	0	69.19N	149.16W	26	166	Sagavanirktok	
1775-21121	September 6, 1974	20	71.53N	146.27W	24	171	Beaufort Sea	
1775-21124	September 6, 1974	0	70.36N	148.43W	25	169	Beechey Point	
1775-21130	September 6, 1974	0	69.19N	150.44W	26	166	Sagavanirktok	
1775-21133	September 6, 1974	0	68.00N	152.31W	27	164	Chandler Lake	
1776-21200	September 7, 1974	0	65.19N	157 02W	29	161	Kateel River	
1776-21202	September 7, 1974	0	63.58N	158.22W	30	159	Nulato	
1776-21205	September 7, 1974	0	62.36N	159.35W	31	158	Holy Cross	
1777-21233	September 8, 1974	0	71.51N	149.22W	23	171	Beaufort Sea	

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1778-21292	September 9, 1974	0	71.53N	150.39W	23	171	Beaufort Sea
1778-21301	September 9, 1974	1	69.20N	154.56W	25	167	Teshekpuk
1778-21303	September 9, 1974	0	68.01N	156.44W	26	165	Lookout Ridge
1778-21310	September 9, 1974	0	66.42N	158.21W	27	163	Selawik
1778-21312	September 9, 1974	0	65.21N	159.48W	28	161	Candle
1778-21315	September 9, 1974	0	64.01N	161.07W	29	160	Norton Bay
1778-21321	September 9, 1974	0	62.39N	162.20W	31	158	St. Michael - Kwiguk
1779-21361	September 10, 1974	0	68.04N	158.10W	26	165	Howard Pass
1779-21364	September 10, 1974	1	66.45N	159.47W	27	163	Selawik
1779-21370	September 10, 1974	0	65.25N	161.15W	28	161	Candle
1779-21373	September 10, 1974	0	64.04N	162.34W	29	160	Solomon
1779-21375	September 10, 1974	20	62.42N	163.47W	30	158	Kwiguk
1784-20244	September 15, 1974	20	57.11N	149.04W	33	154	Gulf of Alaska
1786-20340	September 17, 1974	30	63.59N	146.45W	27	161	Big Delta
1787-20421	September 18, 1974	10	55.45N	154.15W	33	153	Gulf of Alaska
1789-20493	September 20, 1974	5	69.21N	144.50W	21	168	Mt. Michelson
1793-21110	September 24, 1974	5	78.07N	143.44W	16	176	Beaufort Sea
1794-21170	September 25, 1974	5	71.57N	147.37W	17	173	Beaufort Sea
1802-20213	October 3, 1974	0	65.29N	142.28W	19	165	Charley River
1802-20220	October 3, 1974	0	64.08N	143.49W	20	163	Delta - Eagle
1802-20222	October 3, 1974	0	62.46N	145.02W	22	162	Gulkana
1802-20225	October 3, 1974	0	61.24N	146.09W	23	160	Valdez
1802-20231	October 3, 1974	2	60.02N	147.10W	24	159	Seward - Cordova
1802-22040	October 3, 1974	15	68.11N	165.10W	17	168	Point Hope
1802-22043	October 3, 1974	2	66.51N	166.48W	18	166	Shishmaref
1803-20263	October 4, 1974	0	68.11N	140.39W	16	168	Table Mt.
1803-20265	October 4, 1974	0	66.52N	142.17W	18	166	Coleen
1803-22085	October 4, 1974	0	70.46N	162.34W	14	172	Wainwright
1803-22092	October 4, 1974	0	69.30N	164.37W	15	170	Point Lay
1803-22094	October 4, 1974	5	68.11N	166.27W	16	168	Point Hope
1803-22110	October 4, 1974	10	64.12N	170.56W	20	163	St. Lawrence Island
1804-20310	October 5, 1974	0	72.01N	135.44W	13	174	Beaufort Sea
1804-20312	October 5, 1974	5	70.45N	138.04W	14	172	MacKenzie Bay
1805-20373	October 6, 1974	10	69.25N	141.40W	15	170	Demarcation Point
1808-20585	October 9, 1974	30	55.55N	158.28W	25	157	Stepovak Bay
1808-20592	October 9, 1974	30	54.31N	159.16W	26	156	Simeonof Island
1809-21012	October 10, 1974	0	66.54N	150.53W	15	167	Bettles
1812-21172	October 13, 1974	15	70.50N	149.32W	11	173	Beechey Point
1812-21174	October 13, 1974	10	69.32N	151.36W	12	171	Umiat
1814-21302	October 15, 1974	0	65.36N	159.26W	15	166	Candle
1816-19595	October 17, 1974	10	61.28N	140.23W	18	162	McCarthy & East
1816-21422	October 17, 1974	0	64.10N	163.45W	15	165	Solomon
1816-21424	October 17, 1974	5	62.48N	165.00W	16	163	Black - Kwiguk
1816-21431	October 17, 1974	15	61.27N	166.09W	17	162	Hooper Bay
1817-21453	October 18, 1974	0	72.03N	154.26W	08	175	Beaufort Sea
1817-21460	October 18, 1974	0	70.47N	156.46W	09	173	Barrow
1817-21462	October 18, 1974	0	69.30N	158.50W	10	171	Lookout Ridge
1817-21471	October 18, 1974	3	66.52N	162.19W	12	168	Kotzebue
1817-21480	October 18, 1974	15	64.11N	165.10W	15	165	Solomon
1818-21532	October 19, 1974	15	65.34N	165.24W	13	166	Teller - Nome
1818-21534	October 19, 1974	20	64.12N	166.45W	14	165	Nome
1819-21595	October 20, 1974	20	62.51N	169.26W	15	164	St. Lawrence Island
1820-22054	October 21, 1974	3	62.50N	170.51W	15	164	St. Lawrence Island
1821-22094	October 22, 1974	20	68.13N	166.29W	10	169	Point Hope
1821-22100	October 22, 1974	0	66.53N	168.08W	11	168	Chukchi Sea
1821-22105	October 22, 1974	5	64.12N	171.00W	13	165	St. Lawreece Island
1826-20584	October 27, 1974	20	55.54N	158.28W	19	159	Stepovak Bay
1835-21463	November 5, 1974	0	66.55N	162.22W	06	168	Kotzebue
1829-20293	November 9, 1974	20	55.58N	151.14W	15	160	Gulf of Alaska
1840-20324	November 10, 1974	0	64.14N	146.32W	07	166	Fairbanks - Delta
1840-20335	November 10, 1974	0	60.07N	149.58W	11	162	Kenai - Seward
1840-20342	Novmeber 10, 1974	15	58.44N	150.57W	12	162	Gulf of Alaska
1840-22155	November 10, 1974	30	64.13N	172.21W	07	166	Siberia - St. Lawrence Is.
1840-22162	November 10, 1974	15	62.51N	173.37W	09	165	Bering Sea
1923-19504	February 1, 1975	5	58.37N	141.01W	11	154	Gulf of Alaska
1932-20413	February 10, 1975	0	59.59N	153.00W	12	154	Illiamna
1932-20420	February 10, 1975	0	58.36N	153.57W	13	153	Afognak
1932-20422	February 10, 1975	0	57.13N	154.51W	14	152	Karluk
1932-20425	February 10, 1975	0	55.50N	155.41W	15	151	Trinity Islands
1933-20474	February 11, 1975	0	58.34N	155.26W	14	152	Mt. Katmai
1942-21371	February 20, 1975	10	64.17N	163.48W	12	156	Solomon
1942-21374	February 20, 1975	0	62.56N	165.02W	13	155	Yukon River Delta
1942-21380	February 20, 1975	0	61.34N	166.11W	14	154	Hooper Bay
1942-21383	February 20, 1975	0	60.11N	167.14W	15	153	Nunivak Island
1942-21385	February 20, 1975	20	58.48N	168.13W	17	152	Bering Sea
1943-21403	February 21, 1975	10	72.04N	154.33W	06	167	North of Barrow
1943-21405	February 21, 1975	30	70.48N	156.52W	08	165	Meade River
1945-21521	February 23, 1975	30	70.49N	159.45W	08	165	Wainwright
1946-20164	February 24, 1975	5	64.12N	143.48W	14	156	Delta - Eagle
1946-21582	February 24, 1975	30	69.30N	163.17W	10	162	Point Lay
1946-21585	February 24, 1975	20	68.11N	165.08W	11	161	Point Hope
1946-21591	February 24, 1975	0	66.52N	166.46W	12	159	Bering Straits
1946-21594	February 24, 1975	0	65.31N	168.16W	13	158	Bering Straits
1947-22040	February 25, 1975	5	69.31N	164.40W	10	162	Point Lay
1947-22043	February 25, 1975	5	68.13N	166.30W	11	161	Point Hope
1947-22045	February 25, 1975	10	66.53N	168.10W	12	159	Chukchi Sea
1948-20265	February 26, 1975	20	68.12N	142.13W	11	161	Table Mt.
1948-22094	February 26, 1975	10	69.30N	166.09W	10	162	Arctic Ocean
1948-22101	February 26, 1975	5	68.11N	168.00W	12	161	Point Hope & Chukchi Sea
1949-22152	February 27, 1975	5	69.31N	167.33W	11	162	Chukchi Sea
1949-22155	February 27, 1975	2	68.12N	169.23W	12	161	Chukchi Sea
1949-22164	February 27, 1975	10	65.33N	172.32W	14	157	Bering Straits
1949-22170	February 27, 1975	0	64.12N	173.54W	15	156	Chukotsk Penn.

1949-22173	February 27, 1975	0	62.51N	175.08W	16	155	Bering Sea
1949-22175	February 27, 1975	0	61.29N	176.17W	17	154	Bering Sea
1950-20375	February 28, 1975	0	69.30N	143.12W	11	162	Demarcation Point
1950-20382	February 28, 1975	0	68.12N	145.02W	12	161	Arctic
1951-20433	March 1, 1975	0	69.28N	144.37W	12	162	Mt. Michelson
1951-20440	March 1, 1975	1	68.10N	146.27W	13	161	Arctic
1952-20491	March 2, 1975	0	69.30N	146.04W	12	162	Mt. Michelson
1952-20500	March 2, 1975	15	66.53N	149.34W	14	159	Chandalar - Beaver
1954-21040	March 4, 1975	15	58.43N	159.42W	21	151	Nushagak Bay
1956-21113	March 6, 1975	0	70.55N	149.34W	12	165	Beechey Point
1956-21120	March 6, 1975	0	69.38N	151.39W	13	163	Umiat
1957-21171	March 7, 1975	10	70.54N	151.06W	13	165	Harrison Bay
1957-21174	March 7, 1975	10	69.37N	153.11W	14	163	Ikpikpuk River
1958-21230	March 8, 1975	20	70.56N	152.22W	13	165	Harrison Bay
1959-21281	March 9, 1975	0	72.14N	151.24W	12	167	Beaufort Sea
1959-21284	March 9, 1975	0	70.58N	153.47W	13	165	Teshekpuk
1959-21295	March 9, 1975	0	67.04N	159.25W	17	159	Baird Mountains
1959-21302	March 9, 1975	20	65.43N	160.56W	18	157	Candle
1959-21304	March 9, 1975	5	64.22N	162.18W	19	156	Norton Sound
1960-21335	March 10, 1975	0	72.12N	152.53W	13	167	Beaufort Sea
1960-21342	March 10, 1975	0	70.57N	155.15W	14	165	Barrow
1965-20200	March 15, 1975	0	69.30N	139.00W	17	163	Herschel Island
1965-20211	March 15, 1975	0	65.31N	143.59W	20	157	Circle - Charlie River
1965-20214	March 15, 1975	0	64.10N	145.21W	21	156	Big Delta
1965-20220	March 15, 1975	5	62.48N	146.35W	22	154	Mt. Hayes
1966-20242	March 16, 1975	0	73.21N	133.22W	14	170	Beaufort Sea
1966-20245	March 16, 1975	0	72.07N	136.01W	15	167	Beaufort Sea
1966-20251	March 16, 1975	0	70.51N	138.21W	16	165	Beaufort Sea
1966-20254	March 16, 1975	2	69.34N	140.25W	17	163	Herschel Island
1966-20274	March 16, 1975	0	62.53N	148.00W	23	154	Healy - Talkeetna Mts.
1968-20355	March 18, 1975	0	73.19N	136.10W	15	170	Beaufort SEa
1968-20361	March 18, 1975	0	72.05N	138.49W	16	167	Beaufort SEa
1968-20370	March 18, 1975	1	69.32N	143.12W	18	163	Demarcation Point
1968-20373	March 18, 1975	0	68.13N	145.03W	19	161	Arctic
1968-20375	March 16, 1975	10	66.53N	146.42W	20	159	Christian
1968-22202	March 18, 1975	10	69.31N	169.04W	18	163	Chukchi Sea
1969-20413	March 19, 1975	0	73.21N	137.33W	15	170	Beaufort Sea
1969-20442	March 19, 1975	10	64.14N	150.59W	23	156	Kantishna River - Fairbanks
1974-21111	March 24, 1975	05	69.34N	151.54W	21	163	Umiat
1975-21163	March 25, 1975	5	70.52N	151.17W	20	165	N.of Harrison Bay
1976-21212	March 26, 1975	0	73.24N	147.30W	18	170	Beaufort Sea
1976-21221	March 26, 1975	0	70.53N	152.31W	20	165	Harrison Bay
1977-21272	March 27, 1975	20	72.09N	151.44W	20	168	Beaufort Sea
1979-21382	March 29, 1975	0	73.21N	151.57H	19	170	Beaufort Sea
1979-21385	March 29, 1975	0	72.06N	154.34W	20	168	Beaufort Sea
1980-21443	March 30, 1975	5	72.07N	156.09W	21	168	N. of Barrow
1982-21564	April 1, 1975	5	69.30N	163.27W	24	163	Point Lay
1982-21571	April 1, 1975	5	68.12N	165.10W	25	161	Point Hope
1983-22011	April 2, 1975	0	73.18N	157.53W	21	171	Chukchi Sea
1983-22013	April 2, 1975	0	72.04N	160.31W	22	168	Floeberg
1983-22022	April 2, 1975	0	69.30N	164.52W	24	163	Point Lay - Chukchi Sea
1983-22025	April 2, 1975	0	68.11N	166.42W	25	161	Point Hope
1983-22031	April 2, 1975	5	66.52N	168.21W	26	159	Bering Straits
1984-20242	April 3, 1975	0	70.44N	138.33W	24	165	Beaufort Sea
1984-20245	April 3, 1975	20	69.27N	140.35W	25	163	Herschel Island
1984-20251	April 3, 1975	0	68.08N	142.24W	26	161	Table Mts.
1984-20254	April 3, 1975	0	66.48N	144.02W	27	159	Fort Yukon
1984-20260	April 3, 1975	0	65.27N	145.29W	28	157	Circle
1984-20263	April 3, 1975	0	64.06N	146.49W	29	155	Fairbanks - Delta
1984-20265	April 3, 1975	0	62.44N	148.03W	30	154	Talkeetna Mts.
1984-22065	April 3, 1975	0	73.17N	159.22W	21	171	Chukchi Sea
1984-22080	April 3, 1975	20	69.29N	166.22W	25	163	Chukchi Sea
1985-20291	April 4, 1975	0	73.17N	134.57W	22	171	Beaufort Sea
1985-20303	April 4, 1975	0	69.30N	141.56W	25	163	Demarcation Point
1985-20305	April 4, 1975	0	68.11N	143.46W	26	161	Table Mts.
1985-20312	April 4, 1975	0	66.51N	145.24W	27	159	Fort Yukon
1986-20354	April 5, 1975	5	70.48N	141.19W	24	165	Beaufort Sea
1986-20361	April 5, 1975	5	69.30N	143.14W	25	163	Demarcation Point
1986-20363	April 5, 1975	0	68.11N	145.11W	26	161	Arctic
5000-20141	April 19, 1975	25	64.06N	144.00W	35	155	Delta - Eagle
5003-20291	April 22, 1975	0	70.43N	140.02W	31	166	Beaufort Sea
5003-20293	April 22, 1975	2	69.36N	142.05W	32	163	Demarcation Pt.
5003-20300	April 22, 1975	0	68.07N	143.54W	33	161	Table Mt
5003-20302	April 22, 1975	0	66.47N	145.32W	34	159	Fort Yukon
5003-20305	April 22, 1975	0	65.27N	147.01W	35	157	Livengood
5003-20311	April 22, 1975	0	64.06N	148.21W	36	155	Fairbanks
5003-20314	April 22, 1975	0	62.44N	149.33W	37	153	Talkeetna Mts.
5004-20351	April 23, 1975	10	69.26N	143.32W	32	163	Demarcation Point
5004-20354	April 23, 1975	0	68.07N	145.21W	33	161	Arctic
5004-20360	April 23, 1975	0	66.47N	147.00W	34	159	Fort Yukon
5020-20230	May 9, 1975	15	69.23N	140.46W	37	163	Herschel Island
2072-21280	April 4, 1975	0	72.04N	149.41W	23	170	Beaufort Sea
2075-21452	April 7, 1975	0	72.03N	154.13W	24	170	Beaufort Sea
2075-21484	April 7, 1975	0	61.25N	167.25W	33	155	Hooper Bay
2075-21490	April 7, 1975	10	60.02N	168.29W	34	153	Bering Sea
2076-21540	April 8, 1975	5	62.49N	167.45W	32	156	Black
2076-21542	April 8, 1975	0	61.27N	168.51W	33	155	Hooper Bay
2076-21510	April 8, 1975	0	72.04N	155.44W	25	170	Beaufort Sea
2076-21513	April 8, 1975	10	70.48N	158.01W	26	168	Meade River
2076-21515	April 8, 1975	10	69.31N	160.09W	27	166	Utukok River
2076-21522	April 8, 1975	10	68.12N	162.00W	28	163	DeLong Mt.

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2076-21524	April 8, 1975	15	66.52N	163.40W	29	161	Kotzebue
2076-21533	April 8, 1975	0	64.11N	166.31W	31	158	Nome
2076-21545	April 8, 1975	5	60.04N	169.57W	34	153	Bering Sea
2077-21580	April 9, 1975	2	68.10N	163.28W	28	163	DeLong Mts.
2077-21583	April 9, 1975	0	66.50N	165.06W	29	161	Shishmaref
2077-21585	April 9, 1975	0	65.30N	166.35W	30	160	Teller
2077-21592	April 9, 1975	0	64.09N	167.56W	31	158	Nome
2078-22030	April 10, 1975	10	70.41N	161.00W	26	168	Wainwright
2078-22032	April 10, 1975	10	69.24N	163.03W	28	165	Point Lay
2078-22035	April 10, 1975	0	68.05N	164.54W	29	163	Point Hope
2078-22041	April 10, 1975	0	66.45N	166.33W	30	161	Shishmaref
2078-22044	April 10, 1975	0	65.25N	168.02W	31	160	Teller
2078-22050	April 10, 1975	0	64.04N	169.23W	32	158	St. Lawrence Island
2078-22053	April 10, 1975	0	62.42N	170.37W	33	156	St. Lawrence Island
2079-22084	April 11, 1975	20	70.40N	162.35W	27	168	Wainwright
2079-22091	April 11, 1975	10	69.22N	164.38W	28	165	Point Lay
2079-22093	April 11, 1975	0	68.04N	166.29W	29	163	Point Hope
2079-22100	April 11, 1975	0	66.44N	168.08W	30	161	Chukchi Sea
2080-20343	April 12, 1975	20	59.56N	149.58W	36	153	Blying Sound
2080-20352	April 12, 1975	10	57.09N	151.50W	38	150	Gulf of Alaska
2080-20354	April 12, 1975	10	55.45N	152.42W	39	143	Gulf of Alaska
2080-22145	April 12, 1975	10	69.22N	166.03W	28	165	Point Hope
2080-22151	April 12, 1975	0	68.04N	167.52W	29	163	Point Hope
2080-22160	April 12, 1975	5	65.23N	171.00W	32	159	Chukotsk Penn.
2081-20372	April 13, 1975	15	69.20N	141.48W	29	165	Demarcation Point
2082-22262	April 14, 1975	10	69.16N	169.04W	29	165	Chukchi Sea
2083-20473	April 15, 1975	5	73.05N	137.49W	26	173	Beaufort Sea
2083-22320	April 15, 1975	0	69.16N	170.35W	30	165	Chukchi Sea
2085-20595	April 17, 1975	5	70.44N	145.19W	29	168	Flaxman Island
2085-22421	April 17, 1975	0	73.14N	166.07W	27	174	Chukchi Sea
2087-21105	April 19, 1975	0	72.00N	145.54W	29	171	Beaufort Sea
2087-21112	April 19, 1975	0	70.43N	148.13W	30	168	Beechey Pt
2087-21114	April 19, 1975	0	69.26N	150.15W	31	166	Umiat
2088-21161	April 20, 1975	0	73.14N	144.42W	28	174	Beaufort Sea
2088-21163	April 20, 1975	0	71.59N	147.20W	29	171	Beaufort SEa
2088-21170	April 20, 1975	0	70.43N	149.39W	30	168	Beechey Point
2088-2-172	April 20, 1975	0	69.26N	151.42W	31	166	Umiat
2091-19544	April 23, 1975	15	58.35N	140.52W	41	151	Gulf of Alaska
2092-20000	April 24, 1975	0	59.56N	141.20W	40	152	Icy Bay
2092-20002	April 24, 1975	5	58.33N	142.18W	41	151	Gulf of Alaska
2092-20011	April 24, 1975	10	55.46N	144.02W	43	148	Gulf of Alaska
2092-20014	April 24, 1975	20	54.22N	144.50W	44	146	Gulf of Alaska
2092-21393	April 24, 1975	0	71.56N	153.02W	30	171	Beaufort Sea
2092-21402	April 24, 1975	0	69.22N	157.24W	33	166	Lookout Ridge
2092-21411	April 24, 1975	0	66.44N	160.52W	35	162	Selawik
2092-21414	April 24, 1975	0	65.23N	162.21W	36	160	Bendeleben
2093-21451	April 25, 1975	0	71.54N	154.30W	31	171	Beaufort Sea
2094-21542	April 26, 1975	0	61.17N	168.52W	40	154	Bering Sea
2094-21544	April 26, 1975	10	59.54N	169.59W	41	152	Bering Sea
2095-21564	April 27, 1975	0	71.52N	157.31W	31	171	Chukchi Sea
2095-21571	April 27, 1975	0	70.36N	159.48W	32	168	Wainwright
2095-21573	April 27, 1975	25	69.18N	161.50W	34	166	Utukok River
2095-21585	April 27, 1975	15	65.19N	166.44W	37	159	Teller
2095-21591	April 27, 1975	10	63.58N	168.04W	38	158	Norton Sound
2095-21594	April 27, 1975	10	62.37N	169.18W	39	156	St. Lawrence Island
2095-22000	April 27, 1975	0	61.15N	170.25W	40	154	Bering Sea
2096-22025	April 28, 1975	20	70.31N	161.24W	33	168	Wainwright
2096-22032	April 28, 1975	20	69.13N	163.25W	34	166	Point Lay
2096-22034	April 28, 1975	15	67.54N	165.13W	35	163	Point Hope
2096-22041	April 28, 1975	0	66.34N	166.49W	36	161	Shishmaref
2096-22050	April 28, 1975	20	63.53N	169.34W	38	157	St. Lawrence Island
2096-22052	April 28, 1975	15	62.31N	170.47W	39	156	St. Lawrence Island
2096-22055	April 28, 1975	10	61.09N	171.54W	40	154	BEring Sea
2096-22061	April 28, 1975	10	59.47N	172.57W	41	152	St. Matthew
2097-22075	April 29, 1975	0	73.00N	158.00W	31	174	Chukchi Sea
2096-22081	April 29, 1975	0	71.45N	160.36W	32	171	Floeberg
2097-22084	April 29, 1975	20	70.29N	162.52W	33	168	Wainwright
2097-22090	April 29, 1975	15	69.11N	164.52W	34	166	Point Lay
2097-22093	April 29, 1975	10	67.53N	166.39W	35	163	Point Hope
2097-22102	April 29, 1975	0	65.13N	169.44W	38	159	Bering Straits
2097-22104	April 29, 1975	5	63.53N	171.03W	39	157	St. Lawrence Island
2097-22113	April 29, 1975	5	61.08N	173.23W	41	154	Bering Sea
2098-20310	April 30, 1975	0	70.34N	138.22W	33	168	Beaufort Sea
2098-20313	April 30, 1975	2	69.16N	140.23W	35	166	Herschel Island
2098-22142	April 30, 1975	15	70.34N	164.07W	33	168	Chukchi Sea
2098-22144	April 30, 1975	0	69.16N	166.09W	35	166	Point Hope
2098-22153	April 30, 1975	0	66.38N	169.36W	37	161	Chukchi Sea
2099-20360	May 1, 1975	15	73.03N	134.55W	31	174	Beaufort Sea
2099-20371	May 1, 1975	20	69.15N	141.47W	35	166	Demarcation Point
2099-20383	May 1, 1975	0	65.17N	146.41W	38	159	Fairbanks - Circle
2099-20385	May 1, 1975	3	63.55N	148.02W	39	157	Fairbanks - Healy
2099-22200	May 1, 1975	20	70.32N	165.39W	34	168	Chukchi Sea
2099-22214	May 1, 1975	0	65.15N	172.34W	34	159	Siberia
2099-22221	May 1, 1975	0	63.54N	173.53W	39	157	Siberia
2099-22223	May 1, 1975	0	62.33N	175.06W	40	155	Bering Sea
2099-22230	May 1, 1975	3	61.10N	176.14W	41	154	Bering Sea
2099-22232	May 1, 1975	0	59.48N	177.16W	42	152	Bering Sea
2100-20444	May 2, 1975	0	63.53N	149.33W	40	157	Fairbanks - Healy
2100-20450	May 2, 1975	5	62.31N	150.46W	41	155	Talkeetna
2100-20455	May 2, 1975	10	59.46N	152.54W	43	152	Illiamna, Seldovia
2100-22250	May 2, 1975	3	73.01N	162.19W	32	174	Chukchi Sea
2100-22252	May 2, 1975	10	71.46N	164.53W	33	171	Chukchi Sea

2103-21001	May 5, 1975	20	68.58N	147.58W	36	165	Sagavanirktok
2104-21055	May 6, 1975	20	68.56N	149.28W	37	165	Philip Smith Mountains
2104-21062	May 6, 1975	20	67.37N	151.14W	38	163	Wiseman
2105-21120	May 7, 1975	20	67.57N	152.12W	38	163	Wiseman
2105-21140	May 7, 1975	20	61.13N	158.59W	43	153	Sleetmute
2105-21145	May 7, 1975	15	58.27N	160.59W	45	150	Hagemeister Island
2105-21152	May 7, 1975	15	57.04N	161.52W	46	148	Bristol Bay
2106-21174	May 8, 1975	0	67.55N	153.42W	38	163	Survey Pass
2106-21181	May 8, 1975	5	66.35N	155.20W	39	161	Hughes
2106-21183	May 8, 1975	15	65.15N	156.48W	40	159	Kateel River
2106-21190	May 8, 1975	10	63.54N	158.08W	41	157	Ophir
2106-21192	May 8, 1975	5	62.32N	159.21W	42	155	Holy Cross
2106-21201	May 8, 1975	20	59.48N	161.30W	44	151	Goodnews
2106-21204	May 8, 1975	20	58.25N	162.27W	45	150	Hagemeister Island
2107-19412	May 9, 1975	5	63.55N	133.52W	41	157	Canada
2107-19421	May 9, 1975	5	61.11N	136.02W	44	153	Lake Laberge
2107-19424	May 9, 1975	0	59.49N	137.04W	45	151	Skagway
2107-19430	May 9, 1975	0	58.27N	138.02W	46	150	Mt. Fairweather
2107-21232	May 9, 1975	20	67.56N	155.07W	38	163	Survey Pass
2107-21235	May 9, 1975	0	66.36N	156.45W	39	161	Shungnak
2107-21241	May 9, 1975	0	65.16N	158.12W	40	159	Kateel River
2108-19473	May 10, 1975	0	62.31N	136.25W	43	155	Canada
2109-21363	May 11, 1975	15	62.28N	163.40W	43	155	Kwiguk
2109-21370	May 11, 1975	5	61.06N	164.45W	44	153	Hooper Bay
2109-21372	May 11, 1975	5	59.44N	165.47W	45	151	Nunivak Island
2110-21404	May 12, 1975	0	67.49N	159.32W	39	163	Baird Mts
2-10-21410	May 12, 1975	10	66.29N	161.09W	40	161	Selawik
2110-21413	May 12, 1975	0	65.08N	162.36W	41	159	Bendeleben
2110-21415	May 12, 1975	20	63.47N	163.55W	42	157	Norton Sound
2110-21431	May 12, 1975	0	59.41N	167.17W	45	151	Nunivak Island
2111-21480	May 13, 1975	0	62.26N	166.34W	44	155	Black
2111-21482	May 13, 1975	0	61.03N	167.41W	45	153	Hooper Bay
2111-21485	May 13, 1975	20	59.41N	168.43W	46	151	Bering Sea
2111-21491	May 13, 1975	5	58.18N	169.40W	47	149	BEring Sea
2112-20093	May 14, 1975	20	65.15N	139.35W	42	159	E. of Charley River
2112-21504	May 14, 1975	0	71.47N	156.11W	36	171	N. of Barrow
2112-21513	May 14, 1975	20	69.13N	160.28W	38	165	Utukok River
2112-21520	May 14, 1975	0	67.54N	162.16W	40	163	Noatak
2113-20143	May 15, 1975	0	67.55N	137.53W	40	163	Canada
2113-20145	May 15, 1975	0	66.36N	139.30W	41	161	East of Black River
2113-20152	May 15, 1975	20	65.15N	140.59W	42	159	Charley River
2113-21560	May 15, 1975	20	73.01N	155.06W	35	174	Beaufort Sea
2113-21590	May 15, 1975	10	63.53N	168.07W	43	157	St. Lawrence
2113-21563	May 15, 1975	1	71.46N	157.40W	36	171	Chukchi Sea
2113-21565	May 15, 1975	0	70.30N	159.56W	38	168	Wainwright
2113-21572	May 15, 1975	15	69.13N	161.56W	39	165	Utukok River
2113-21574	May 15, 1975	0	67.54N	163.44W	40	163	Noatak
2113-21581	May 15, 1975	40	66.35N	165.20W	41	161	Shishmaref
2114-20201	May 16, 1975	0	67.55N	139.21W	40	163	East of Coleen
2114-22030	May 16, 1975	20	69.13N	163.21W	39	165	Point Lay
2114-22033	May 16, 1975	0	67.54N	165.08W	40	163	Noatak
2114-22035	May 16, 1975	10	66.35N	166.45W	41	161	Shishmaref
2114-22042	May 16, 1975	5	65.15N	168.13W	42	159	Teller
2115-22105	May 17, 1975	0	62.32N	172.12W	44	155	Bering Sea
2115-22111	May 17, 1975	0	61.09N	173.19W	46	153	BEring Sea
2115-22114	May 17, 1975	0	59.47N	174.20W	47	151	BEring Sea
2115-22120	May 17, 1975	0	58.24N	175.18W	47	149	Bering Sea
2116-20350	May 18, 1975	2	56.58N	151.53W	49	147	Gulf of Alaska
2117-20372	May 19, 1975	15	67.50N	143.41W	41	163	Black River
2117-20374	May 19, 1975	15	66.31N	145.17W	42	160	Circle
2118-20424	May 20, 1975	5	69.15N	143.18W	40	165	Demarcation Point
2118-20430	May 20, 1975	10	67.55N	145.05W	41	163	Christian
2118-20433	May 20, 1975	25	66.36N	146.42W	42	161	Fort Yukon
2118-22255	May 20, 1975	5	69.18N	168.57W	40	165	Chukchi Sea
2119-20482	May 21, 1975	10	69.29N	144.16W	40	166	Mt. Michelson
2119-20484	May 21, 1975	0	68.11N	146.07W	41	163	Arctic
2120-20584	May 22, 1975	20	54.40N	158.57W	51	143	Simeonof Island
2122-19254	May 24, 1975	0	58.28N	133.43W	49	148	Juneau
2124-21160	May 26, 1975	10	73.04N	144.57W	38	174	Beaufort Sea
2126-21273	May 28, 1975	0	73.01N	147.56W	38	173	Beaufort Sea
2126-21275	May 28, 1975	20	71.47N	150.29W	39	170	Beaufort Sea
2127-21345	May 29, 1975	20	67.53N	158.06W	43	162	Ambler River
2127-21352	May 29, 1975	20	66.33N	159.43W	44	160	Selawik
2127-21354	May 29, 1975	10	65.13N	161.11W	45	158	Candle
2127-21361	May 29, 1975	5	63.52N	162.31W	46	156	St. Michael
2127-21363	May 29, 1975	10	62.30N	163.43W	47	153	Kwiguk
2127-21375	May 29, 1975	5	58.24N	166.47W	50	147	Bering Sea
2128-21390	May 30, 1975	15	73.00N	150.53W	38	173	Beaufort SEa
2129-21472	May 31, 1975	15	65.12N	164.02W	45	157	Bendeleben
2129-21474	May 31, 1975	0	63.51N	165.22W	46	155	Norton Sound
2129-21481	May 31, 1975	10	62.30N	166.35W	47	153	Black
2129-21483	May 31, 1975	30	61.07N	167.42W	48	151	Hooper Bay
2130-21530	June 1, 1975	5	65.09N	165.33W	45	157	Teller
2131-21580	June 2, 1975	0	67.49N	163.56W	43	162	Noatak
2131-21585	June 2, 1975	15	65.09N	166.58W	45	157	Teller
2132-22034	June 3, 1975	0	67.45N	165.27W	43	162	Noatak
2134-22154	June 5, 1975	20	66.33N	169.45W	44	159	Bering Straits
2134-22160	June 5, 1975	15	65.13N	171.12W	46	157	Chukotsk Penn.
2135-22215	June 6, 1975	5	65.12N	172.38W	46	157	Chukotsk Penn.
2135-22221	June 6, 1975	20	63.52N	173.58W	47	155	Bering Sea

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APPENDIX C

Horizons on Display

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News Release on Horizons on Display Award

The Geophysical Institute's Remote Sensing Program is sporting the official symbol of the American Revolution Bicentennial Administration these days. Specifically, the Institute's project which applied satellite photos to land selection decisions by Doyon, Ltd. is one of 200 community projects chosen for inclusion in the "Horizons on Display" program sponsored by the Department of Housing and Urban Development and the American Revolution Bicentennial Administration. The "Horizons" program recognizes the problem solving capacity of communities in improving the quality of life for all.

The sponsors hope the project will open a dialogue among communities and provide a forum for information exchange among citizens, private organizations and all levels of government. As visitors travel throughout America during the Bicentennial many will want to visit certain communities cited by the Horizons award to learn first hand about how challenges have been met as people help people in a local, problem-solving level. Information about the Remote Sensing Program and the other 199 national award-winning projects is available at the LANDSAT library browse facility, 208 Elvey Building.

The Remote Sensing Program at the Geophysical Institute, with support from the Bureau of Indian Affairs and NASA, undertook to make the benefits from the latest space technology available to Doyon, the regional Native corporation. Doyon's boundaries encompass a region that is complicated by existing federal and state withdrawals and is large, varied, far-flung and which contains a variety of resources such as petroleum and mineralized lands and is forested with spruce and birch of commercial quality.

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The Native Claims Settlement Act authorized Doyon to select about one out of every three acres that were withdrawn for their selection. In effect this meant that for each acre Doyon selected, it was rejecting two other acres and, therefore, it was important to know well the resources within the Doyon withdrawal.

Satellite photos from NASA's LANDSAT spacecraft were used in conjunction with other information to map the extent of commercial timber and mineral potential in seven key regions in the territory withdrawn for Doyon's land selections. These results enabled Doyon's land selection decisions to be based upon better information than could possibly have existed otherwise. Space technology was effectively used to maximize the resource management decisions by Alaskan Natives in a manner which is both economically sound and which is consonant with their cultural heritage.

The Remote Sensing Program at the Geophysical Institute is under the leadership of John Miller and Albert Belon, although much of the data analysis of the Doyon project was done by Lewis Shapiro, James Anderson and William Stringer.

AMERICAN REVOLUTION BICENTENNIAL
1776-1976

Certificate of Official Recognition

Accorded to

Remote Sensing Program
Fairbanks, Alaska
for participation in Horizons On Display

By the
American Revolution
Bicentennial Administration

John W. Warner
Administrator

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APPENDIX D

USDA Soil Conservation Service Reports

Range Resource Inventory from Digital Satellite Imagery on the Baldwin Peninsula, N.W. Alaska

Identification of Flood Hazard Resulting from Aufeis Formation in an Interior Alaskan Stream

Range Resource Inventory from Digital Satellite Imagery on the Baldwin Peninsula, N. W. Alaska

This study was prepared for the Soil Conservation Service
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RANGE RESOURCE INVENTORY FROM DIGITAL SATELLITE IMAGERY

ON THE BALDWIN PENINSULA, NW ALASKA

INTRODUCTION:

The Alaska Native Claims Settlement Act designated that some 40 million acres of land in Alaska would be transferred to native ownership. Regional and village corporations, established by the natives to manage the land, are now investigating specific potential uses for their domain. The NANA regional corporation is considering the operation of a reindeer herd on and around the Baldwin Peninsula in Northwest Alaska and has requested assistance from the United States Department of Agriculture's Soil Conservation Service to help set up the herd.

A range inventory is the first step toward successful herd operation. Plant communities are identified and correlated with soil types to define range sites; the extent and location of these sites is mapped. Yield data is then obtained to allow computation of the annual volume of plant material available for sustained grazing. With this information stocking rates can be computed and management practices developed to insure the well-being of the herd and the protection of the range for continued production.

The Soil Conservation Service and the Geophysical Institute initiated a study to assess the feasibility of producing a range inventory from Landsat Data. This endeavor focused on the mapping of plant communities of a portion of the Baldwin Peninsula. The objectives of this study were: 1) to prepare a range map from Landsat data, 2) evaluate the map, and, 3) make recommendations for refinement of the method for future applications. It is anticipated that the use of satellite imagery and computer-aided methods of analysis can be implimented to greatly speed up the process of range land inventory.

LANDSAT DATA

Landsat orbits the earth at an altitude of 565 miles. Photoelectric detectors on board scan a path directly below the satellite and measure the light energy reflected from the surface in discrete wavelengths (bands) in the visual and near infrared region of the electromagnetic spectrum. These measurements are recorded as digital electronic signals that are beamed to a ground tracking station and recorded on magnetic tape. Each discreet signal is called a pixel and accounts for the average reflectance of an area on the ground roughly 79 meters (259 feet) on a side. The information from these pixels can be then reassembled from the magnetic tapes and recorded on film by means of an electron beam recorder to make an image representing an area 185 km (115 miles) on a side. This information is gathered for four bands (wavelengths) and the resulting images can be combined with color filters to make false color photograph-like images. These images, now photographic products, are then used at various scales for photo interpretation, density slicing, and a variety of analysis techniques.

The original magnetic tapes can also be converted into tapes in a computer compatible format. A high speed computer can then treat each pixel individually allowing precision processing unattainable by a human interpreter. In the simplest case the computer could search through the more than 7 million pixels of one band from one scene and identify all those which have a given reflectance value. In actual practice these are a host of manipulations (called algorithms) that have been developed to classify the separate spectral characters of the individual pixels into a relatively small number of spectral classes.

COMPUTER CLASSIFICATION METHOD

The classification used in this study was derived by computer analysis of tapes of LANDSAT scene 1330-21525, acquired on June 18, 1973. The unsupervised classification technique used is outlined in Figure 1. Initially a subscene was selected for study. For this classification a random sampling technique wherein rectangular blocks of 100 pixels were selected randomly totalling 2% of the subscene. A "cluster analysis" was performed on the four band sample data to separate and identify spectral classes. Statistics were then generated for the 27 classes which had been identified giving for each spectral band the mean intensity and standard deviation for each cluster. The next step was to take the statistics generated and apply them to the raw data with a maximum likelihood classifier algorthm that assigned each pixel of the subscene to the class it was closest to spectrally. Following geometric correction, a computer line printer map was generated with each pixel depicted as belonging to the one of 27 spectral catagories in which the maximum likelihood algorithm has placed it. A computer tape of this classification result was also produced for use later in the project. This portion of the analysis was done without any input about the nature of the study, i.e., range or field information. The only criteria for classification was the spectral distribution of the data. The remainder of the analysis dealt with identification or significant spectral classes.

FIELD STUDY AND ANALYSIS

In early August, 1974, a field trip was made to the Baldwin Peninsula to gain some first hand information about the area. Oblique aircraft and surface photographs were acquired with color infrared ektachrome film to document vegetation patterns and locations. Detailed field notes

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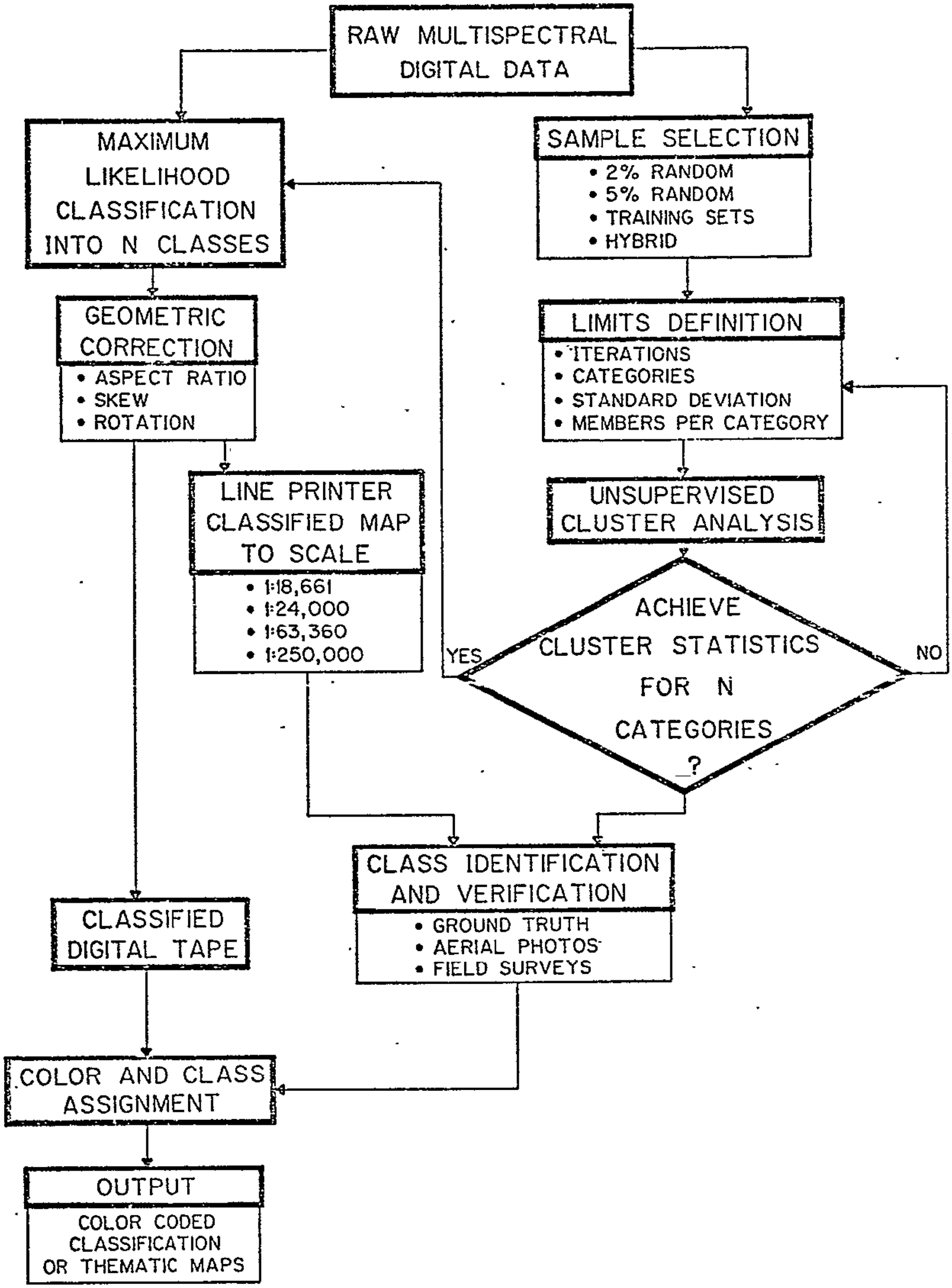

Figure 1 Flow chart for generating LANDSAT unsupervised classifications.

were taken describing plant types and composition of plant communities on the Peninsula.

The plant community descriptions can be converted to range sites when correlated with soil types. The rangeland on the Baldwin Peninsula represents summer reindeer range. The narrow neck of the Peninsula is fenced to separate the north and south areas, thereby increasing management options. For example, good management might require a north Peninsula herd that winters in the Kiana hills and a herd in the south wintering in the Selawik Hills (See Fig. 2).

Following the field trip, two days were spent reducing the field data and correlating it to the results of the computer classification. The LANDSAT subscene which had been classified contained a portion of the mainland and Kobuk River delta as well as part of the Baldwin Peninsula. Since the Peninsula was of prime interest to the NANA corporation, our efforts were focused there. The spectral classes found mostly on the mainland were excluded from consideration in this study.

This phase of the analysis involved an evaluation of the LANDSAT spectral classes. Categories that have no bearing on the land mass (i.e., water and ice classes) were identified and excluded. Those remaining were examined on the basis of spectral signature and areal distribution. Similar vegetation classes were combined or "merged" to effectively reduce the number of categories used to represent the plant communities found on the Peninsula.

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The line printer maps showing the 27 spectral classes are high resolution products at a scale of 1:18,660. For viewing purposes the classification results that had been recorded on digital tape were reformatted for use on a CDU-200. This device has a storage disk that drives a color TV

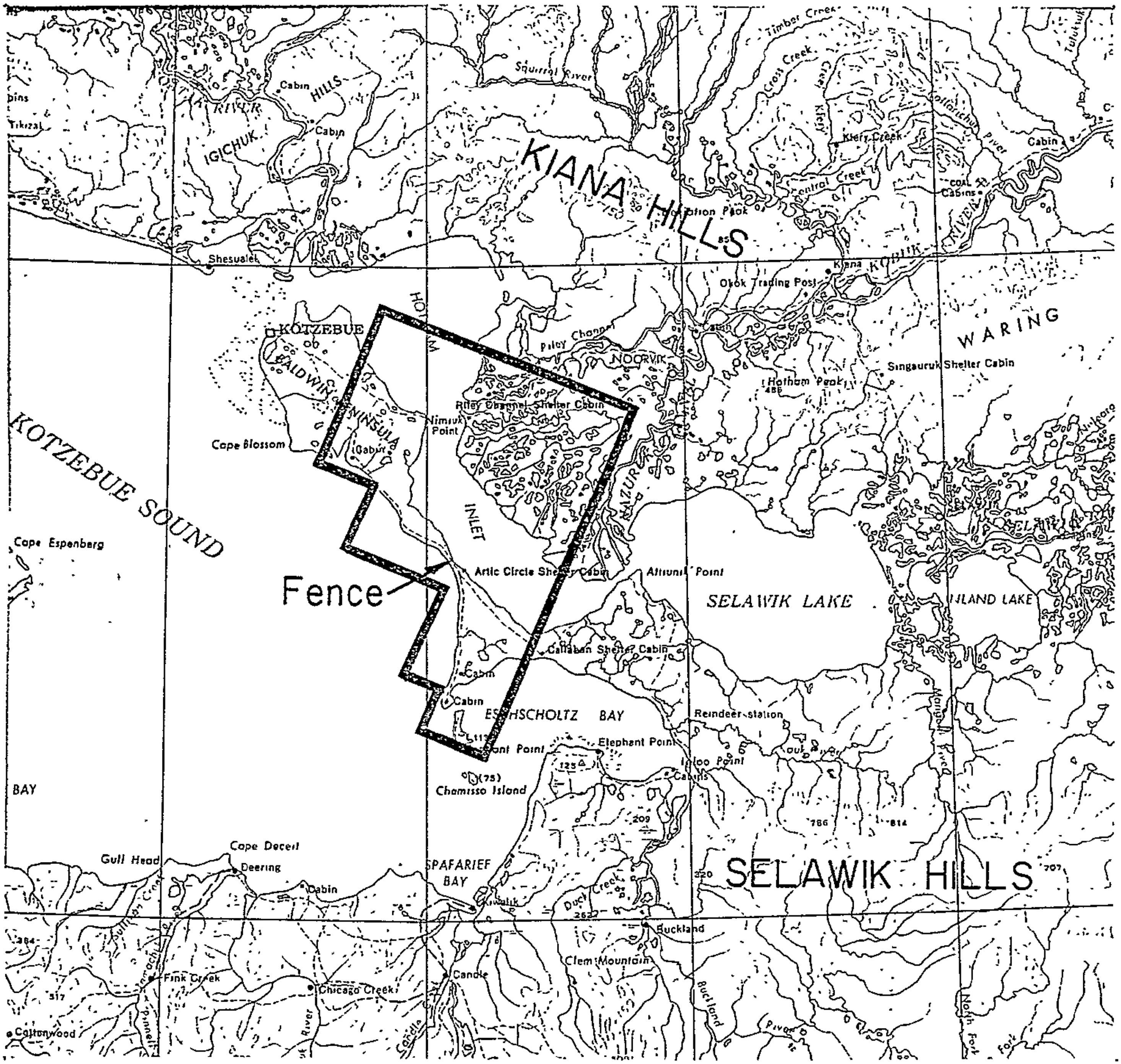

Figure 2 Baldwin Peninsula, Alaska. The area covered by the Landsat classification is outlined. The study was concertrated on the peninsula.

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monitor. A digital encoder controls the display and allows the analyst to view computer classification results of a 512 X 512 pixel subscene in 16 different colors at a scale of approximately 1" = 1 mile. The CDU-200 also allows the analyst to merge classes (i.e., make classes 1, 3, and 5 all yellow) and compare the result with ground truth information collected in the field. In a few hours of study a final merging was derived for range inventory purposes.

RESULTS

The 25 spectral classes originally identified by the cluster analysis were merged into 7 broad categories shown in Figure 3. Of these, four are important for range use. The initial plant communities and species composition categories were compiled from field notes and appear in Table 1. The acreage figures for each computer class have been calculated from pixel counts and are included in the key to Figure 3.

Color prints showing the seven categories (Fig. 3), produced from the computer classification results on an optical drum recorder, were enlarged to scales of 1:250,000 and 1:63,360, the two map scales available in Alaska. To evaluate the results of the classification, ground coverage of 80 aerial oblique color infrared slides acquired during the field trip was located on 1:63,360 scale maps. The maps were then superimposed with the color product on a light table and computer categories (now displayed as colors) compared to vegetation patterns identified from the slides. The following are descriptions of the seven classes:

Arctic Tundra (orange) Reindeer summer range. This is the major plant community found on the Baldwin Peninsula. This plant community is often associated with the presence of ice-wedge polygons. This site can be further broken down physiographically into "flat-

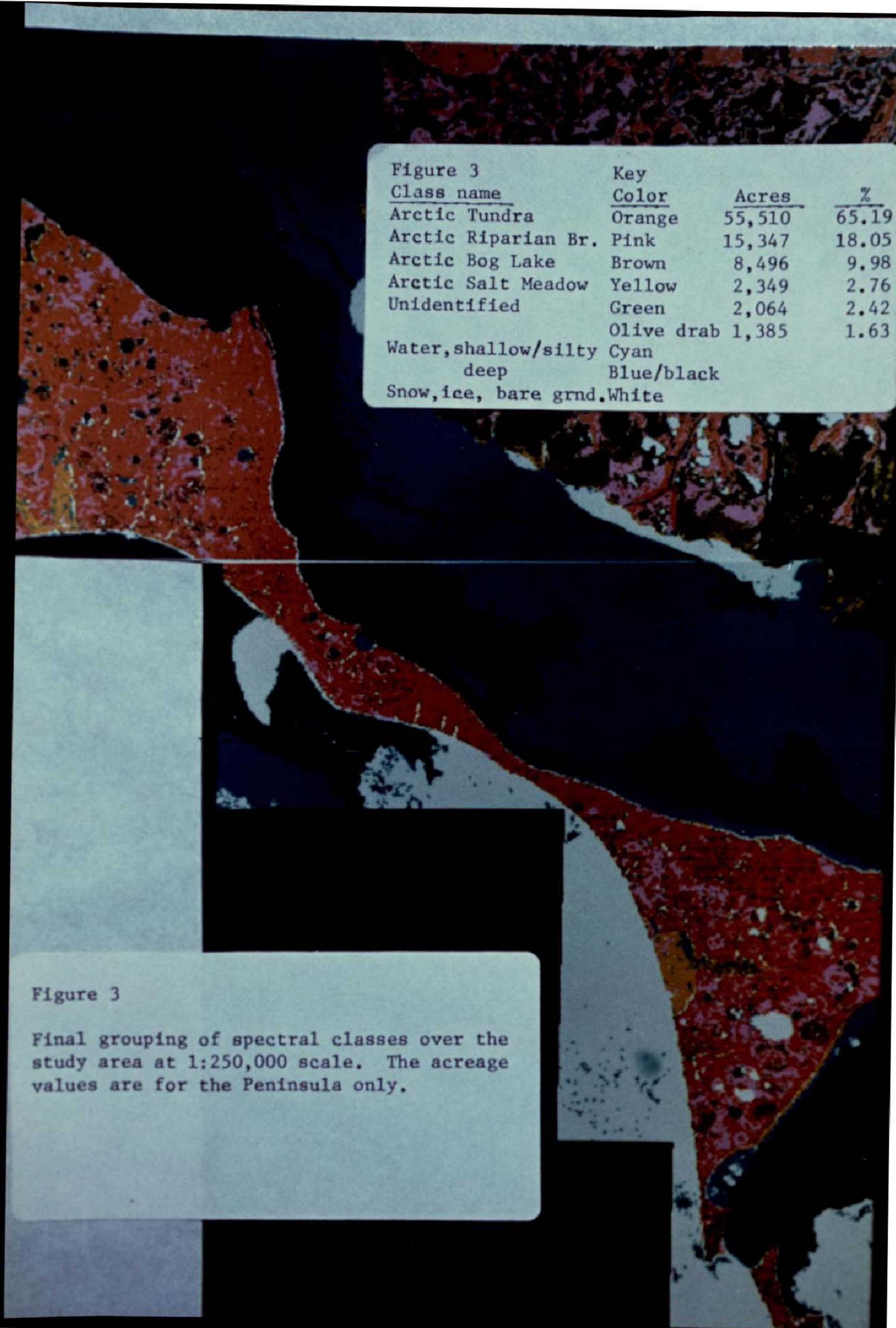

Figure 3

Class name	Key Color	Acres	%
Arctic Tundra	Orange	55,510	65.19
Arctic Riparian Br.	Pink	15,347	18.05
Arctic Bog Lake	Brown	8,496	9.98
Arctic Salt Meadow	Yellow	2,349	2.76
Unidentified	Green	2,064	2.42
	Olive drab	1,385	1.63
Water, shallow/silty	Cyan		
deep	Blue/black		
Snow, ice, bare grnd.	White		

Figure 3

Final grouping of spectral classes over the study area at 1:250,000 scale. The acreage values are for the Peninsula only.

wet" and "rolling, better-drained" categories. In terms of plant production the two are nearly identical. In composition the "rolling, better-drained" tundra has more Carex and less Eriophorum than "flat-wet" and is associated with upland brush.

Arctic Riparian Brush (pink) This plant community is associated with the "wet-flat" tundra areas. It is found along small streams and lakes. Willow is the dominant plant in this community.

Arctic Bog Lake (brown) This is an emerging plant community from eutrophying lakes and therefore almost always found in circular remnants of drained lakes. Reindeer use would be for summer range only.

Arctic Salt Meadow (yellow) This plant community is associated with shallow brackish salt water (up to 50% of the class) and wet bare ground (30%). Productivity is significant, (1000#/acre est.) even though the plants are limited to 20% of the area within the class.

Shallow or silty water (blue) This class includes shallow lakes and sediment-laden sea water.

Deep water (blue-black) Deeper lakes and sea water make up this category.

Unidentified (green and olive drab) These classes are dominant on the Kobuk River Delta. They are primarily wet bog and marsh categories. Since the percent present on the Peninsula was small these categories were not considered for range inventory.

Snow, ice and Bare ground (white) There were many spectral categories representing snow, ice and bare ground. Because the chief object here was to distinguish among vegetation categories, these non-vegetative categories were all assigned the same representation.

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One of the benefits of a digital analysis is that the computer can sum the pixels in each class. With this information and knowing the area covered by each pixel, average figures were computed for each class. Since the study area was limited to the Baldwin Peninsula, some special considerations had to be made to separate the pixel counts from the mainland. To do this, rectangles extending into the water bodies were defined and special pixel counts generated of sub areas. These counts were then summed to yield the values presented on Figure 3. For this reason the water (blue and blue black) and snow, ice and bareground (white) classes were excluded from area figures in order to establish percentages between the range land categories.

DISCUSSION

The comparision of oblique color slides to the computer-generated color product for the most part verified the classes described initially. The Salt Meadow and Bog Lake categories stand out very clearly on the color product. During the field trip two physiographic regions on the Peninsula were noted: on the north side of the land mass the topography consists of low rolling hills, the southern areas are flat lowlands with many thaw lakes at various stages of drainage. The uplands are better drainaged and have a significant amount of alder brush and related shrubs growing on the hill slopes. None of the computer identified spectral classes distinguished this upland brush category. Arctic Riparian Brush (pink) was found predominantly in the drainage valleys and lowland areas around old lake beds.

The Landsat scene used for the classification was acquired June 18, 1973. It was selected for analysis because it was the only existing scene of the area at that time. Inspection of the standard color

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Figure 4. Landsat scene 1330-21525 acquired June 18, 1973. Digital tapes of this scene were used for the study.

image (Figure 4) shows that the sea ice has not yet completely melted and is piled along the southern shore of the Peninsula. Some of the inland lakes are covered with ice, and snow lines the drainages and lake shores which have sharp relief. There is an absence of color contrast in the land mass characteristic of early seasonal conditions; e.g., when the leaves of the taller shrubs are not yet as well developed. It was concluded that the classification results give an accurate representation of conditions as they were on June 18, but that the upland brush was not yet spectrally distinct from the tundra and is included with the larger Arctic Tundra class. Subsequent visual examination of Landsat imagery acquired through the summers of 1974 and 1975 revealed that later in the season (July and August) more contrast in the near infrared wavelengths is evident in the areas containing brush. This is consistent with the color infrared photographs acquired during the field trip of August, 1975. Future studies in this area should use imagery from later in the season, preferably late July or early August.

In order to make an accurate range map for the study area that accounted for the upland brush category, another remote sensing tool was brought into use. Because of the low sun angle, winter Landsat imagery shows enhanced topographic features. The shadows cast by the hills on the peninsula make it possible to differentiate the upland hills from the lowland flats. Manual photo interpretation of Landsat scene 1619-21531 (3 April 1974) and topographic maps was used to separate the upland hills from the lowland categories. This boundary was then transferred to the classification results (Fig. 5 - overlay). A plant species and percent composition list for Arctic Upland Brush was developed from field notes

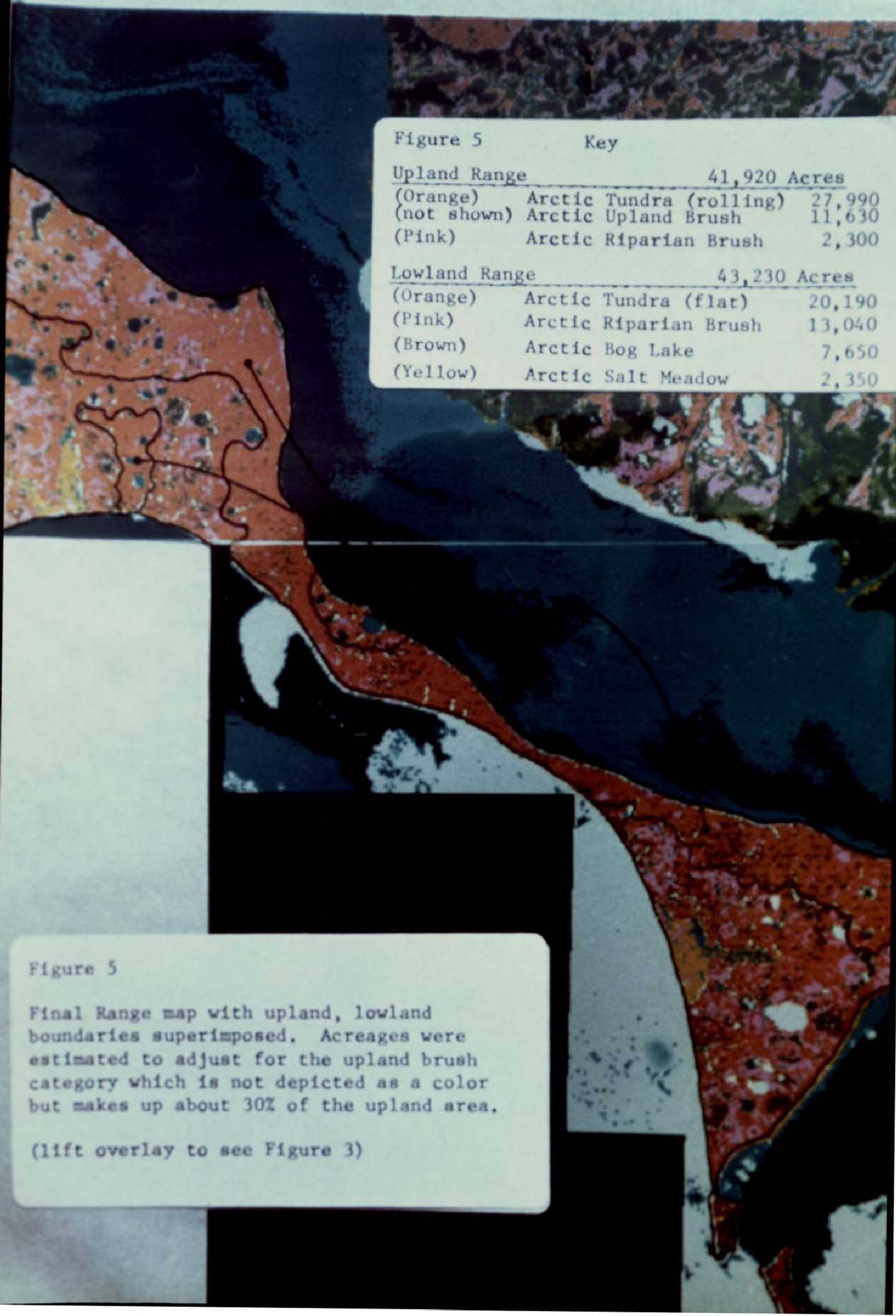

Figure 5

Final Range map with upland, lowland boundaries superimposed. Acreages were estimated to adjust for the upland brush category which is not depicted as a color but makes up about 30% of the upland area.

(lift overlay to see Figure 3)

and is included in the final plant communities description (Table 2). Estimates of the percent of upland brush were made from the oblique aircraft photography. This percentage was applied to the estimated acreage of the upland hills to yield an area value for Arctic Upland Brush. Similar estimates were made for the other plant communities based on a grid count of 1:63,360 scale color product to derive the final acreage figures for the study area (presented on the caption of Figure 5). In this manner the plant community categories of importance have been identified and described for range land management.

This study was limited in extent and time of preparation and dealt strictly with plant communities. In an operational project the spectral classes identified on the satellite imagery would be correlated to soils as well as plants to define range sites, using the same method of analysis. The result would then constitute a range map.

CONCLUSION

In summary, digital analysis of Landsat Imagery can be a valuable tool for range inventory of tundra regions of Northwest Alaska. This range inventory data could be converted into reindeer stocking rates. Additional information needed is; 1) data concerning the plant species that are utilized by reindeer, 2) percent by weight of these plants available on a sustained yield basis, and 3) management options to maintain the plant yield (i.e. rotational grazing). Range categories can also be identified with other uses. The flat tundra area is associated with water fowl use, while rolling tundra is not. Multiple use of resources is encouraged. Identification of uses when correlated with the range classes can allow optimum relationships to be developed.

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Improvements to this method of inventory can be made by choosing a scene from the best season for vegetative differentiation - late July or early August for the Baldwin Peninsula. Performing exploratory level mapping by photo interpretation from satellite summer color imagery, late winter imagery, and topographic maps prior to computer analysis would allow a more intensive sampling technique (than a random sample) to be used. The availability of aerial photography covering strips of the study area would provide information to use for the grouping of spectral classes to reduce the origional 20-30 classes down to 7-10 as required by the individual study. Once the final spectral classes are designated a color product can be generated at 1:63,360 scale. This product can be overlayed by a topographic map at the same scale and transects assigned for field checking. The acreage and percentage figures computed from the classification data can be used to calculate the intensity of field checking required to statistically sample the study area.

After field verification the final color product can serve as the base for the range map showing the range types, distribution, and extent available for use in the management of reindeer in the tundra regions of Alaska.

BALDWIN PENINSULA — INITIAL PLANT COMMUNITY DESCRIPTION — TABLE 1

COMPUTER CLASS	COLOR	GENERAL DESCRIPTION	DETAIL DESCRIPTION: Plant Name -	% composition, dry wt., current year's growth	NOTES
3,6	Orange	Arctic Tundra-a "grass-like tussock" meadow distinguished by poly-gons.	Eriophorum/Carex	50	Reindeer summer range... most abundant plant community on Baldwin Peninsula. The Eriophorum (Alaska Cotton) is in the form of tussocks on the ridges of the polygons.
			Calamagrostis (Bluejoint)	5	
			Oxycoccus (Low cranberry)		
			Vaccinium uliginosum (Alpine blueberry)	10	
			Spiraea Beauverdiana (Alaska spirea)	3	
			Ledum palustre (Laborador tea)	10	
			Arctostaphylos rubra	Trace	Estimated total annual yield, current year's growth air dry = 1000#/Acre
			Betula nana	10	
			Rubus chamaemorus (Cloud berry)	2	
			Empetrum nigrum (Crow berry)	5	
			Salix sp. (low)	5	
			Petasites	3	
			Pedicularis	2	
			Sphagnum (moss)	2	
			Pyrola grandiflora	Trace	
			Dryas integrifolia	Trace	
			Litter	-	
				100%	
9's & "C's"	Pink	Arctic Riparian Brush - A mixed brush, grass-like plant community.	Carex/Eriophorum	40	A fresh water-related community.
			Calamagrostis (bluejoint)	2	
			Poa sp.	3	
			Gentiana sp.	2	
			Pyrolia grandiflora	2	
			Polemonium sp.	3	Estimated total annual yield, air dry, current year's growth = 1500#/Acre
			Peticides	2	
			Epilobium angustifolium (fireweed)	Trace	
			Aconitum (Monks hood)	Trace	
			Betula nana	5	
			Salix plantifolia (willow)	35	
			Moss	4	
			Lichen, foliose	2	
				100%	

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COMPUTER CLASS	COLOR	GENERAL DESCRIPTION	DETAIL DESCRIPTION		NOTES
"M"	Brown	Arctic Bog Lake-wet meadow eutrophied lake. A grass-like wet plant community.	Eriophorum Carex Calamagrostis Sanguisorba (Burnett) Saxifrage Rumes articus	40 10 50 Trace Trace 100%	The eriophorum is mat forming in the wetter areas. The grass is in the "drier"? areas. Estimate total annual yield, current year's growth, air dry = 1200#/acre
"I"	Yellow	Arctic Salt Meadow-Consisting of: standing water 50% bareground 30% plants 20% 100%	Eriophorum/Carex Calamagrostis (Bluegrass) Festuca (Fescue) Ranunculus (Buttercup) Aster	70 5 10 10 5 100%	Reindeer Summer Range - Estimated total annual yield, current year's growth, air dry = 1000#/Acre
"J",5	Cyan	Shallow or silty water.			
4	Blue	Deep water.			
"D","A",2	Green/ olive drab	Unidentified -- wet tundra-bog classes on the Kobuk delta/ not evaluated in the study area.			
All others	White	Snow-ice and bare ground.			

BALDWIN PENINSULA — FINAL PLANT COMMUNITY DESCRIPTION — TABLE 2

COMPUTER CLASS	COLOR	GENERAL DESCRIPTION	DETAIL DESCRIPTION: Plant Name -	% composition, dry wt., current year's growth	NOTES
3,6	Orange	Arctic Tundra-a "grass-like tussock" meadow distinguished by polygons. This tundra is differentiated into "flat" and "rolling". The "flat" (20,192 Acres) is associated with the low wetlands and the "rolling" (27,139 Acres) with the uplands. These two plant communities are very similar. One difference is that Eriophorum is more abundant on the lower tundra and Carex more abundant on the upper tundra.	Eriophorum/Carex	50	Reindeer summer range... most abundant plant community on Baldwin Peninsula. The Eriophorum (Alaska Cotton) is in the form of tussocks on the ridges of the polygons, especially on the "flat" tundra. Estimated total annual yield, current year's growth air dry = 1000#/Acre
			Calamagrostis (Bluejoint)	5	
			Oxycoccus (Low cranberry)		
			Vaccinium uliginosum (Alpine blueberry)	10	
			Spiraea Beauverdiana (Alaska spirea)	3	
			Ledum palustre (Laborador tea)	10	
			Arctostaphylos rubra	Trace	
			Betula nana	10	
			Rubus chamaemorus (Cloud berry)	2	
			Empetrum nigrum (Crow berry)	5	
			Salix sp. (low)	5	
			Petasites	3	
			Pedicularis	2	
			Sphagnum (moss)	2	
			Pyrola grandiflora	Trace	
			Dryas integrifolia	Trace	
			Litter	-	
				100%	
9's & "C's"	Pink	Arctic Riparian Brush - A mixed brush, grass-like plant community.	Carex/Eriophorum	40	A fresh water-related community.
			Calamagrostis (bluejoint)	2	
			Poa sp.	3	
			Gentiana sp.	2	
			Pyrolia grandiflora	2	
			Polemonium sp.	3	Estimated total annual yield, air dry, current year's growth = 1500#/Acre
			Peticides	2	
			Epilobium angustifolium (fireweed)	Trace	
			Aconitum (Monks hood)	Trace	
			Betula nana	5	
			Salix plantifolia (willow)	35	
			Moss	4	
			Lichen, foliose	2	
				100%	

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COMPUTER CLASS	COLOR	GENERAL DESCRIPTION	DETAIL DESCRIPTION		NOTES
(not correlated to satellite data. See text)		Arctic Upland Brush-an upland, Alder Brush dominated plant community.	Carex	8	An important upland brush plant community. This is the most productive plant community on the Baldwin Peninsula
			Calamagrostis (Bluejoint)	2	
			Peticides	2	
			Epilobium augustifolium (Fireweed)	Trace	
			Aconitum (Monks hood)	1	
			Alnus (Alder)	30	
			Salix (Willow)	15	Estimated total annual yield, current year's growth, air dry = 2000#/Acre
			Vaccinium uliginosum (Blueberry)	10	
			Spiraea Beauverdiana (Alaska spirea)	5	
			Empertum nigrum (Crowberry)	2	
			Betula nana (Dwarf birch)	10	
			Ledum palustre (Labrador tea)	8	
			Lichen	2	
			Equisetum (Horsetail)	5	
				100%	
"M"	Brown	Arctic Bog Lake-wet meadow eutrophied lake. A grass-like wet plant community.	Eriophorum	40	The eriophorum is mat forming in the wetter areas. The grass is in the "drier"? areas. Estimate total annual yield, current year's growth, air dry = 1200#/acre
			Carex	10	
			Calamagrostis	50	
			Sanguisorba (Burnett)	Trace	
			Saxifraga		
			Rume articus	Trace	
				100%	
"I"	Yellow	Arctic Salt Meadow-Consisting of: Standing Water 50%, bareground 30%, plants 20%, 100%	Eriophorum/Carex	70	Reindeer Summer Range -
			Calamagrostis (Bluegrass)	5	
			Festuca (Fescue)	10	Estimated total annual yield, current year's growth, air dry = 1000#/Acre
			Ranunculus (Buttercup)	10	
			Aster	5	
				100%	
"J",5	Cyan	Shallow or silty water.			
4	Blue	Deep water.			

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COMPUTER CLASS	COLOR	GENERAL DESCRIPTION	DETAIL DESCRIPTION	NOTES
"D","A",2	Green/ olive drab	Unidentified -- wet tundra-bog classes on the Kobuk delta/ not evaluated in the study area.		
All others	White	Snow-ice and bare ground.		

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USDA SCS-PORTLAND OREG 1973

IDENTIFICATION OF FLOOD HAZARD RESULTING FROM AUFEIS FORMATION IN AN INTERIOR ALASKAN STREAM

An Information and Evaluation Report prepared for the Soil Conservation Service as part of a feasibility study to evaluate the utility of LANDSAT imagery for flood hazard analysis and consequent land-use decisions.

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ABSTRACT

LANDSAT band 5 and 7 data have been combined to produce a multispectral product which allows identification and mapping of areas flooded during April 1974 as a result of aufeis formation in Jarvis Creek near Delta Junction, Alaska. The resulting map has been produced at a scale of one inch to the mile to serve as flood documentation for a multiagency cooperative effort to develop a land use plan for the Big Delta area. The planning requirements imposed by aufeis formation and subsequent flooding are discussed briefly.

I. Introduction

During the Spring of 1974 the Geophysical Institute and the Soil Conservation Service entered into a joint program to investigate the utility of LANDSAT data for identification of potential flood-hazard areas in Alaska. The location chosen for this study was the Big Delta Planning Area, a region approximately 120 by 40 miles centered at Delta Junction, Alaska, one hundred miles southeast of Fairbanks (see Figure 1). LANDSAT imagery and digital tapes have been used to provide land-form and vegetational information related to flood hazard analysis as well as historical flood data for the study area. In Alaska, flooding occurs as a result of all causes known to be responsible for floods in temperate regions and, in addition, as a result of conditions unique to arctic and subarctic regions. One of these conditions is the creation of "aufeis" (stream glaciering) during winter months which often results in channel blockage and subsequent diversion of stream waters. This report details the use of LANDSAT data to document one such event of flooding and its implications to land use planning.

II. LANDSAT Data

Detailed descriptions of LANDSAT data can be found in many places. Here we will briefly describe only those aspects and characteristics of the satellite data which have a direct bearing on this paper.

The chief function of LANDSAT is to acquire photograph-like imagery of the earth which can be used for earth-resource or land-use analysis. The imagery is acquired by means of photo-electronic sensors, each of which measures the light reflected by the earth in a narrow wavelength band. Each sensor scans the earth in a systematic manner to generate an image. Light areas on the image represent earth surface features reflecting large quantities of energy in the wavelength being measured. The wavelength bands measured by LANDSAT include green, red and two near-infrared wavelength bands. Although the term "infrared" is often associated with heat, the infrared region actually spans the electro-magnetic spectrum all the way from red light to microwave wavelengths. The two infrared bands monitored by LANDSAT lie just beyond the visible red wavelengths in the electromagnetic spectrum and are not in any way used as an indication of heat. However, chlorophyll strongly reflects these two wavelengths, with the result that healthy plants reflect these wavelengths well. Water, on the other hand, strongly absorbs radiation in the infrared bands.

The most common data products available from LANDSAT are the now-familiar black-and-white photograph-like images produced by the individual LANDSAT sensors. Each product is commonly referred to by the wavelength band monitored; thus, a "band 5 image" refers to the image produced by the sensor monitoring red light reflected from the earth, while a "band 7 image" refers to an image representing reflected energy in the more red of the two infrared wavelength bands monitored.

Each wavelength band monitored was chosen for its utility for different aspects of resource and land use analysis: band 5, for instance, monitors cultural features while band 4 (green) monitors suspended sediments.

The satellite travels around the earth approximately every 90 minutes on a polar orbit. The relationship between the orbit and field of view (about 100 miles) is such that at the equator the satellite images adjacent locations on successive days providing an overlap of about ten percent. A given "scene" is repeated every eighteen days. At central Alaskan latitudes, because of convergence of the polar orbit paths and the resulting greater image overlap, a given location may be imaged three days in succession. At this time there are two LANDSATs in operation with their orbits arranged so that it is technically possible to image a given location in Alaska three of every nine days.

III. Aufeis

Ice-forming situations occur all winter in the arctic and subarctic wherever there are continuous sources of water and freezing temperatures exist.[1] An obvious example of this situation is that of a stream fed by an active, year-round spring: The spring water will be subjected to freezing temperatures and under most conditions will freeze somewhere along the stream. When new ice continues to form on top of older ice, this condition is described by the German term, aufeis (literally "upon

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ice"). Aufeis can build up to fill normal stream channels and cause the stream to flow onto the nearby flood plain. If this happens during winter months, the flooding waters freeze nearby. If, however, the flooding occurs during spring it often does not freeze but rather behaves in a normal flood fashion subject to diversion resulting from the aufeis formations which may have built up during the winter.

IV. Detection of Flooding as a Result of Aufeis in the Vicinity of Delta Junction, Alaska

As part of the search for historical flood data in the Big Delta area, all existing LANDSAT images available for that area were examined. Images acquired on April 25 and 26, 1974, showed a large dark area (particularly on the infrared band images) several miles in length lying to the east of Delta Junction. This condition was interpreted as flooding because of the very strong indicated absorption of band 6 and 7 infrared radiation.

As part of the joint program of flood hazard analysis, a flood history report of the Delta area was compiled[3] based on existing records and interviews of persons living in the area. This report made note of a yearly flooding situation which was recognized as describing what had been identified on the LANDSAT images:

> Jarvis Creek, also a tributary of the Delta River, has created problems in the populated Delta Junction area for a number of years. During breakup it jumps its channel as a result of ice blockage, and several times has flowed in an alternate route to the Delta River, running through a subdivision and past the airport. In the last ten years, however, a U. S. Army-built block of this alternate channel has prevented flooding in the airport area. Since the Jarvis continues to jump its banks yearly, it was forced to find another channel, and now flows for approximately two weeks each spring along the west side of a (north-south) ridge which terminates just north of Jack Warren Road. Several hundred feet beyond this the stream sinks into porous ground, and is lost in a bog which stretches north to the Tanana River. Although this only happens once a year, the flow of water is great enough that two large culverts are needed, and are frequently inadequate, to channel it under Jack Warren Road.

Often flooding resulting from aufeis remains localized because freezing temperatures cause freezing of the flooding waters in the immediate vicinity of the location of the stream diversion. In this particular case, during the period in question the daily temperatures ranged from near freezing at night to 50°F during the day.[2] Hence, the flood waters were free to flow with little restriction.

Although this springtime flooding condition had long been recognized in the Delta area, the source and extent of the flooding was not mapped prior to the analysis of the Spring 1974 LANDSAT imagery. Similar flooding was noted exactly one year later when at least one local resident found it necessary to take action to divert similar flood waters. Unfortunately, because of cloudy conditions at the time, LANDSAT data is not available to document the flooding that year.

V. Data Enhancement Techniques

Although the flooded areas could be partially identified on LANDSAT band 7 images, the identification was somewhat ambiguous. In order to produce a data product of more utility, a multi-spectral approach was taken. After considerable experimentation, it was found that clearest distinction between features of interest could be obtained using imagery from two of the LANDSAT sensors. The technique used combined data from these two sensors by simultaneously projecting data from the two wavelength bands through colored filters onto a screen.* Band 5 (positive transparency) was projected as green, band 7 (positive transparency) as red and band 7 (negative transparency) as white. The resulting colors of surface objects had no relationship to their true colors, however, the flooded area could be distinguished as light green while bare river beds were brown and ice (including aufeis) red. This combination of projected images was photographed and enlarged to one-inch-to-the-mile scale, and is reproduced here at approximately half that scale.

Figure 2 shows the multispectral data product used to map aufeis and flooding in the Big Delta area. For aid in identifying locations, several cultural features have been transferred to this product from

*A commercial optical device was used for this process. The instrument used is called a "color-additive viewer" and is manufactured by I^{2}S Corp.

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standard maps. Aufeis can be identified on both Jarvis Creek and the Delta River as red while the snow-free bare river beds below these ice formations appear brown. Several ice-covered lakes and ice pans on the Tanana River also appear red.

Water and forests appear various shades of green. The flooding waters have been delineated on this product and it can be seen that the distinction between these two features was clean everywhere except for one location. Here, topographic and vegetational data was used to distinguish between the flood waters and adjacent forest. Only areas that could clearly be identified as flooded were delineated. The problem of linking these areas with flowing floodwaters is addressed below.

VI. Field Reconnaissance

On April 23, 1976, approximately two years after the flooding event which is mapped here, a reconnaissance of the Jarvis Creek area was made by light aircraft. The repetitive nature of Jarvis Creek flooding resulting from aufeis obstruction was borne out by discovery of the aufeis formation and resulting flooding at the same location observed on the LANDSAT imagery.

Figure 3 shows the lower (north) end of the aufeis formation on Jarvis Creek. The actual stream diversion (toward the left) takes place at the location seen approximately in the center of the photograph. Figure 4 shows the bank-full ice conditions at the point of overflow.

At the time of this reconnaissance, the flooding could be followed from the point of diversion to and beyond the Alaska Highway. Generally, the flood waters follow tree-lined stream channels between these two points, spreading out occasionally to fill low areas. Thus it is possible for the flood waters to be confined within the narrow stream channels for portions of their path, escaping detection by LANDSAT because the width of these channels is too small to be detected by the sensors on the satellite. This explains why the flood cannot be followed continuously on Figure 2 from the point of diversion to the highway.

VII. Discussion

This type of ice formation and flooding is common to Arctic and sub-Arctic climates and is a major source of springtime highway maintenance problems in these climatological areas. Flooding resulting from aufeis formations is often the cause of washouts on secondary roads during spring in Alaska. Aufeis-related flooding can be quite dangerous to structures and equipment because it often occurs when temperatures are below freezing or can change to below freezing. To date, despite extensive research, the only truly effective remedy to problems due to aufeis is to avoid placing structures and roads in aufeis or aufeis-flood prone areas. Aufeis formation and related flooding should be a major consideration in the design of any construction project.[4] For these reasons, location of aufeis formation should be a major consideration for land-use planning decisions in Alaska. A typical product for this purpose is shown in Figure 5 where the known flood and aufeis data from Figure 2 has been transcribed onto a standard USGS inch-to-the-mile map. Because only one flooding event of unknown relative magnitude was observed and since it is known that repeated floodings have taken place, statistical hydrologic considerations should be used to project flood hazard onto adjacent potentially flooded lands.

The availability of several year's LANDSAT data should make possible this type of flood hazard analysis for the many areas of Alaska where human activity is anticipated.

Acknowledgments

The research reported here was funded principally by a grant from the Soil Conservation Service and in part by Grant NGL02-001-092 from the National Aeronautics and Space Administration, Office of University Affairs.

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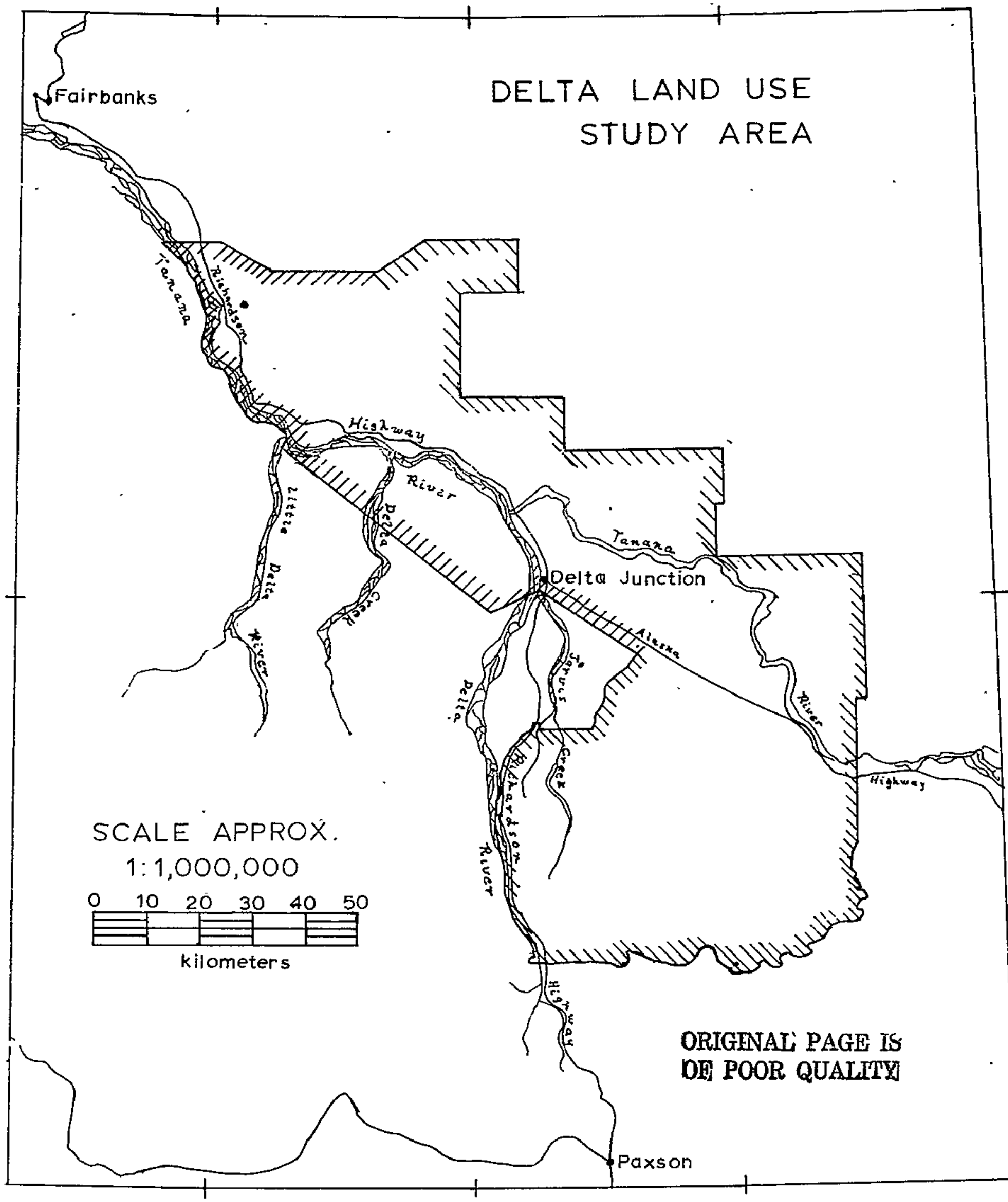

Figure 1. Map showing location and extent of the delta land use study area.

Color Reconstitution
Big Delta, Alaska
LANDSAT Scene 1642-20390
26 April 1974

PREPARED BY:
THE GEOPHYSICAL INSTITUTE
UNIVERSITY OF ALASKA

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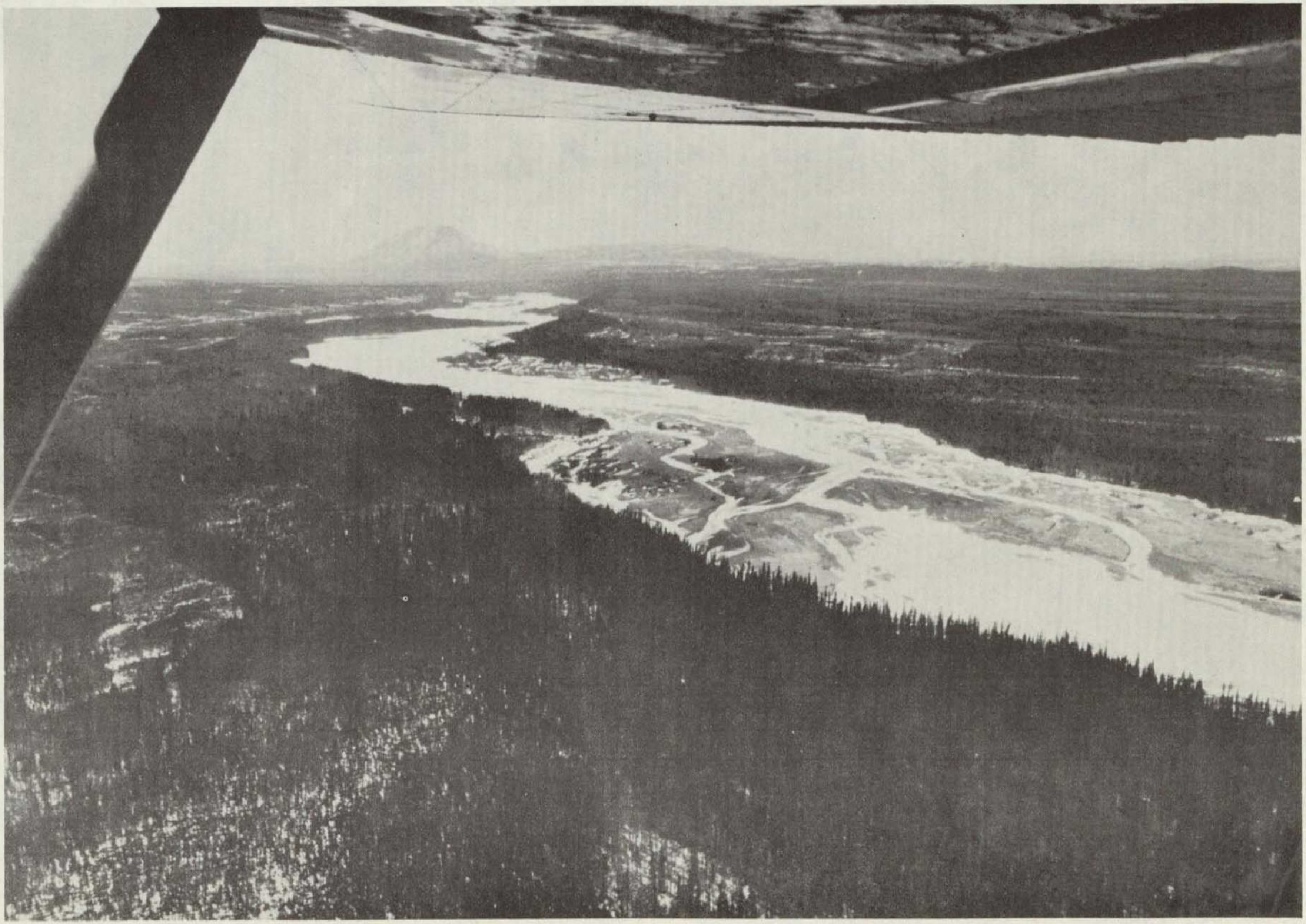

Figure 3. Oblique aerial photograph showing lower (north) end of Jarvis Creek aufeis formation. Diversion of Jarvis Creek waters takes place toward the left at the left extreme of Jarvis Creek in this photograph.

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Figure 4. Oblique aerial photograph showing bank-full ice conditions in region of actual overflow.

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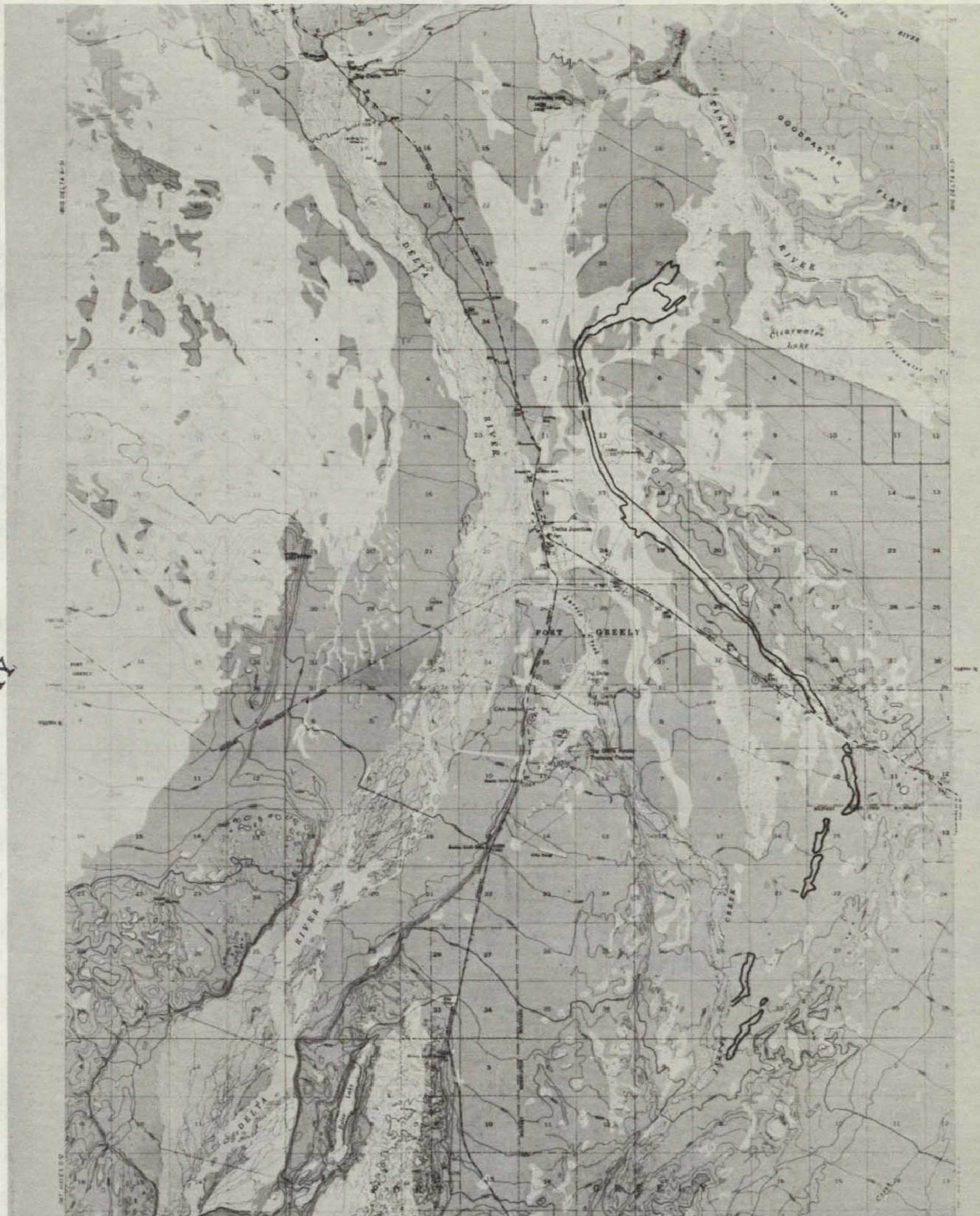

Figure 5. A standard USGS inch-to-the-mile map showing known flood and aufeis data from Figure 2.

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APPENDIX E

Alaska Rural Development Council

Alaska Rural Development Council

1976

GOALS
STRUCTURE
PROGRAM EMPHASIS
MEMBERSHIP
OFFICERS & DIRECTORS

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ALASKA RURAL DEVELOPMENT COUNCIL

Goals:

Improved Communication Between Agencies

Coordinated Assistance to Community, Regional and State Developmental Programs

Broadening Understanding of Rural Development Potentials

Increased Awareness of Technical and Developmental Resources Available in Alaska

Structure:

The Council is open to membership from State and Federal agencies and organizations with statewide developmental concerns.

Officers and directors are chosen annually from the Council members.

Council meetings are held quarterly, with meeting sites rotated throughout the State.

Regional councils are organized to serve Southeast Alaska, Kenai Peninsula, Kodiak Island, Matanuska Valley, and Tanana Valley.

Program Emphasis Priorities:

Agricultural Development -- Long Range Analysis of Future Potential

Developing Water, Waste Disposal and Other Rural Community Facilities

Improved Rural Housing

Land Use Planning and Development

Rural Government Development

Rural Industrial Development

FEDERAL

Department of Agriculture

Secretary's Program Representative: Wally Kubley, member

Agricultural Research Service: Roscoe Taylor, member; Winston Laughlin, alternate

Agricultural Stabilization and Conservation Service: Terence Weiland, member; Faye Bell, alternate

Cooperative Extension Service: James W. Matthews, member; Pete Probasco, alternate

Cooperative State Research Service, Institute of Agricultural Sciences: Sig Restad, member; Charles E. Logsdon, alternate

Farmers Home Administration: Darwin Betts, member

Food and Nutrition Service: Johana Demmert, member

Forest Service: Bob Janes, member; Marc Petty, alternate

Soil Conservation Service: Weymeth E. Long, member; Theodore Freeman, alternate

Department of the Army, Corps of Engineers, Flood Plain Management Services: Mason Wade, Jr., member; Paul Pinard, alternate

Environmental Protection Agency, Arctic Environment Research Lab: Bert Puchtler, member

National Marine Fisheries Service: Walter Jones, member

November, 1976

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Department of Health, Education and Welfare

Alaska Area Native Health Service: Fred Reiff, member
Dr. Ryan, alternate

Department of Housing and Urban Development, Regional Director: Roger Riddell, member; Patricia Stevens, alternate

Department of the Interior

Regional Representative: Heidi Thomas, member

Alaska Power Administration: Robert Cross, member; Tom Wilde, alternate

Fish and Wildlife Service: Clayton Hardy, member; Melvin Monson, alternate

Bureau of Indian Affairs: H. Prent Gazaway, member; Edward L. Nygard, alternate

Bureau of Land Management: Gary Seitz, member; Sal DeLeonardis, alternate

Bureau of Mines: Alfred L. Service, member; John Mulligan, alternate

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STATE

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Department of Environmental Conservation: Jerry Reinwand, member

Department of Health and Social Services, Division of Public Health, Environmental Health Section: Sidney D. Heidersdorf, member; John R. Kuhn, alternate

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Department of Labor: Joseph D. Marshall, member; Roger Meltvedt, alternate

Department of Natural Resources

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University of Alaska

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Agricultural Experiment Station: Sig Restad, member; Charles E. Logsdon, alternate

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School of Management: Richard Solie, member; William G. Phillips, alternate

School of Mineral Industry: Earl Beistline, member; Donald J. Cook, alternate

Sea Grant Program: Donald H. Rosenberg, member; John Doyle, alternate

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Alaska Native Foundation:

Alaska Village Electric Cooperative, Inc.: Loyd Hodson, member

Bering Straits Native Association: Gary Longley, Sr., member

Community Enterprise Development Corp. (CEDC): Jeff Hiatt, member; Kay K. Koweluk, alternate

Fairbanks North Star Borough, Planning Department: Phil Berrian, member; Rick Wilhelm, alternate

Fairbanks TVA Development, Inc.: Jerry Smetzer, member

Rural Alaska Community Action Program, Inc.: Philip Smith, member; Jackie Dailey, alternate

Sealaska Corporation: Richard J. Stitt, Sr., member

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Allan Linn, Alaska Division of Agriculture

Frank McIlhargey, Kenai Peninsula Borough

Fred Reiff, Department of Health, Education, & Welfare

Phil Smith, RurAL CAP

Heidi Thomas, Department of the Interior

Standing Committees:

Human Resource Development: Fred Reiff, Chairman

Local Government, Corporate Activities and Community Facilities: Frank McIlhargey, Chairman

Natural Resources: Allan Linn, Chairman

RESOLUTION

Regarding Utilizing (Developing?) Alaska's Rangeland Potential

Whereas the grazing of livestock, including reindeer and musk oxen has been a part of Alaska's economic base, and

Whereas grazing livestock (especially reindeer) use large acreages of land on an extensive basis, and

Whereas this type of land use when properly managed for the grazing of domestic animals is compatible with many other uses on public lands within fish and wildlife refuges, national forests, national parks, and other public domain lands, and

Whereas there appears to be confusion on the part of potential animal industry people as to the availability of public domain lands for grazing purposes, and

Whereas the decision of federal grazing land availability in Alaska appears to be an agency policy determination,

Therefore, be it resolved that the Alaska Rural Development Council requests the state administration to discuss with top level administrators of the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, National Park Service, Bureau of Indian Affairs, and the University of Alaska the possibilities and procedures for developing grazing permits or leases on land under federal management control, and

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Be It Further Resolved the Council requests that the policy decisions and justifications be made available to the Council, land use planning groups, Alaska Native Corporations, the animal industry, and other agencies and individuals interested in developing Alaska's rangeland potential.

Adopted July 10, 1975
Bethel, Alaska

Report to the Alaskan Rural Development Council on July 9, 1975
by the Calista Regional Corporation

REINDEER INDUSTRY

PART ONE

Some General Considerations

It is probably fair to state that the reindeer industry so far has largely failed in its objectives to provide a stable source of protein and of employment to the people of western Alaska. Furthermore, the mismanagement of the herds and their grazing lands in the 1920's and 1930's greatly reduced the productivity of the range. Recovery from the period of range damage has been slow and has been complete only in areas free of grazing by reindeer for 30 years or longer. A cyclic, boom or bust, reindeer industry has little to recommend it, especially when it carries the spectre of serious range damage. The ideal - the objective of a Calista based reindeer industry - should be to encourage stable, annually harvested herds at levels below the maximum carrying capacity of the habitat: maintaining the range at its highest levels of productivity on a perpetual basis. This ideal will be impossible to achieve unless the methodology of reindeer husbandry and range management can be improved to the highest scientific and technological standards.

A recent report (State of Alaska, 1973) showed that a potential annual market for 2.5 to 3.0 million pounds of reindeer meat has been identified. Production is now inadequate to satisfy the market demands of Native communities in Bethel, Nome, Kotzebue and Barrow; yet the State Division of Economic Enterprise is receiving requests for reindeer meat at any price from many countries, including Japan, Taiwan, Korea, Germany and the Scandinavian countries. However, in terms of the technology of range management and animal population, the reindeer industry is poorly equipped and organized to meet the challenges now being offered.

Based on estimates of former reindeer abundance in western Alaska and our preliminary delimitation of habitat, it is possible that the carrying capacity of the Calista region as a whole may fall somewhere in excess of 50,000 to 70,000 animals. This would permit a total annual harvest of around 10,000 to 14,000 animals. However, these figures represent little more than crude guesswork and considerable research is necessary to approach this question in a valid manner. Even so, the point may be made that large numbers of animals could be raised and harvested within the region on the basis of a range management philosophy that discouraged populations as high as the carrying capacity. At levels safely below the carrying capacity, range productivity could remain high and unimpaired by grazing pressures. Further, the herds would remain in good condition and be highly productive themselves. It is obvious that a highly productive herd (high natality and survival levels) permits a much

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larger annual harvest than an equal sized herd of lower productivity. This concept presumes a harvest level equal to that of the annual increment to the herd (annual increment may be expressed as: number of calves surviving to one year minus the amount of adult mortality).

An approach to the whole question of a reindeer industry in the Calista region requires an analysis on four levels:
1) Habitat suitable for reindeer must be identified. This is given first priority because of imminent-land selection, subsequent management plans, and because of the great interest in prospects for reindeer herding shown by the people of many villages. The map overlays for caribou/reindeer satisfy the need for habitat identification on the basis of vegetation and general topographic parameters. However, a major environmental factor limiting reindeer numbers and activities cannot be evaluated from the ERTS data.

Studies in Eurasia (Formazov, 1946), Canada (Pruitt, 1959) and Alaska (Henshaw, 1968a) have demonstrated the limiting effect of snow depth and hardness factors upon the movements and grazing abilities of the animals. The thresholds of tolerance exhibited by reindeer and caribou are now fairly well understood. A further principle decrees that the amount of range tenable by the animals is determined during the winter by the morphology of the snow cover. As the carrying capacity of range is generally much less during the winter than it is during the snow free months, it becomes impossible to predict true carrying capacity until snow cover surveys have been made. These surveys should be given a high degree of priority, as the suitability of specific areas for reindeer herding cannot be confirmed until this information has been obtained.

2) The relative quality of the vegetation cover in different habitats must be studied in order to estimate carrying capacities on an area to area basis. *See footnote. It follows that a method be devised to monitor changes in range quality and composition following the introduction of reindeer. Carrying capacity is not static in relation to time and with poor management, it can fall drastically due to the grazing and trampling effects of the animals themselves.

3) It is imperative that the ecological history of the former reindeer industry be thoroughly interpreted. From the phenomena of this history, caveats and emergent guidelines can be found and applied towards a renewed phase of reindeer pastoralism. A brief, preliminary analysis of this history is presented below.

*Footnote: This need has already been anticipated. The Upper Kuskokwim Native Association (Glenn Fredericks, viva voce) has already requested the Renewable Resources Department to evaluate reindeer carrying capacities of potential range lands.

4) The technology of reindeer husbandry as it can be applied to western Alaska must be written and disseminated to all persons connected with the industry. This technology should cover all aspects from the elements of herding practise to the science of range management. Husbandry during the previous phase of the reindeer industry was often haphazard and little, and in many cases no attention was paid to the need for training programs and the application of management techniques. As a consequence, serious errors were made, often to the detriment of the herds and the range. A technology for western Alaska must rely heavily upon an examination of the methods tried and proven in Siberia and Scandinavia. This task has already been commenced with reviews of the comprehensive literature from both regions (e.g. Zhigunov, 1961 and Skuneke, 1968). Even so, first hand studies of these industries would be especially valuable.

One of the most striking differences between reindeer husbandry in Alaska and that practiced in Eurasia requires urgent reform. The owners of some Alaskan herds (including that on Nunivak Island) have been persuaded by Korean and Taiwanese interests to harvest antlers for shipment to the far east, where this material is thought to have aphrodisiac properties. This form of harvest is rejected in the U.S.S.R. and the Scandinavian countries for sound biological reasons. However, the Alaskan owners, unfortunately, are unaware of the consequences of this practise upon the well being of their herds.

The antlers are cut off during the late summer at a time when they are still growing and are suffused with blood. The operation is a severe trauma to the animal and serious bleeding may follow. This renders the animal vulnerable to infection and to increased harassment by biting and blood sucking insects. In order to harvest the antlers, the entire herd is driven to the corrals from the summer range, a movement causing much disturbance to the cows and their new calves. During the process of separating out the well antlered animals, the herd tends to assume a rapid milling movement, and this results in many of the calves becoming separated from the mothers or trampled to death. D. Cline (viva voce) felt that the extent of calf loss was such that herd productivity was significantly lowered. The most serious effect of antler removal is not readily apparent, however.

The evolution and functions of antlers, with special reference to caribou and reindeer, has been described previously (Henshaw, 1968b, 1969, 1971). Essentially, antlers serve as the organ of display and threat (and occasionally as a weapon) during social interactions, especially those of a competitive nature. The social hierarchy of reindeer is determined according to relative antler size, and, during the rut, it is the larger antlered bulls that achieve dominance and the highest mating success. Through experimental work in Sweden (Espmark, 1964), it was demonstrated that the superior, large antlered bulls lost their dominance and their high ranking in the hierarchy when their antlers were cut off. The effects of antler removal have been described as "a form of psychological castration" (Henshaw, 1968b), and a lack of breeding

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success has been noted following most experiments in antler removal.

The effects of harvesting living antlers in reindeer herds will be as follows:

1) Disruption of the normal social system and hierarchy.
2) Reduced breeding success by the normally dominant, large antler producing males.
3) Greater breeding success by the inferior males.
4) Reduced genetic quality and vigor in the herd.
5) Reduced productivity by the herd with a subsequent drop in the allowable harvest.

Although it is entirely possible that aphrodisiacs are appreciated by those who may need them, we feel that exploiting western Alaska rangelands for reindeer husbandry is only justified if the primary purpose is to produce a harvest of protein: primarily to meet local needs, but with any surplus going to the lucrative outside markets.

The effects of antler harvesting are inimical to the concept of maintaining healthy herds of good genetic quality for meat production on a sustained yield basis. Because of this and other questions and problems, it would seem mandatory that Calista play an active role in developing and fostering the technology for improved reindeer husbandry within the region. The reindeer industry in Alaska is currently without any central organization or administrative body, and the initiative to reform and develop the industry should come from those organizations directly concerned with the use and management of the land.

PART TWO

The Rise and Fall of the Reindeer Populations (a brief look at a lesson for the future)

> "A population in a limited environment may increase in a logistic fashion, but, unless (it is) properly adjusted to the environment, the fluctuation around the asymptote will be very brief or even lacking, and a crash will immediately follow the production of the maximum population. This crash is a result, mainly, of the fact that the production of even one generation beyond a certain critical population level overshoots the maximum capacity which the environment can support." (Chiang & Hodson, 1950)

The preceding statement describes a phenomena which has occured with remarkable consistency throughout a very wide spectrum of animal species from the fruit fly to the hippopotamus. Although this principle of animal population dynamics is universally known to students of biology, it has, apparently, escaped the attention of the various economists and others who have attempted to explain the decline of reindeer to western Alaska. The reports of these people generally provide a wide array of reasons for the decline, including: losses to migrating caribou herds, over-harvesting, parasitism and disease, and the universal - but undocumented - "catch all" of wolf predation. Undoubtedly, wolves kill a number of reindeer, but the theory is often advanced that wolves were the overwhelming, or even the sole, cause of the decline. Again, this defies a long known and frequently demonstrated principle of animal ecology. Essentially, predator species must remain in a numerical harmony or balance with their prey species in order to survive. This requires that their numbers and behavior must be regulated in ways that help maintain such a balance. Furthermore, behavior which is contrary to this process is aberrant and can have no survival value in terms of a genetic inheritance. If it did, the predator species would overwhelm its food supply and would trend towards self extinction. The millenia of predator/prey co-existence is a demonstration in itself of the fact that wolves have adapted their behavior and numbers so as to maintain their own food supply.

The dynamics of western Alaska reindeer populations have been well described by Leopold and Fraser Darling (1953). From initial introduction from Siberia, totaling 1,280 animals between 1891 and 1902, the herds increased to over 625,000 in 1932. However, there was less than half of this figure 7 years later and the numbers declined to less than 30,000 in the early 1950's. The numbers have remained below 30,000 ever since. The growth and decline curve (Fig. 1-C) of the overall Alaskan populations is broadly representative of the classical pattern illustrated by Chiang & Hodson's (1950) narrative model. The key reference in this instance is the question of whether the populations were "...properly adjusted to the environment..." Clearly, the reindeer of western Alaska were not. Leopold & Fraser Darling (1953) felt that the industry with over half a million reindeer in an immense country with only limited (and largely untrained: J.H.) manpower, was out of control. The authors further stated that there was no safety valve (of adequate harvesting: J.H.) to prevent overstocking of the range; and that relatively little attention was paid to the fact that a major change in the lichen ranges was wrought by the animals themselves. Their final conclusions are reproduced below:

> "We would suggest that the rise and fall of the reindeer population in Alaska is an example on a grand scale, and well documented, of the typical swarming and crashing of an animal population suffering but few checks. It is regrettable

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Fig. 1. Comparison of reindeer population dynamics from two wolf free islands (A+B) and the wolf inhabited mainland (C).

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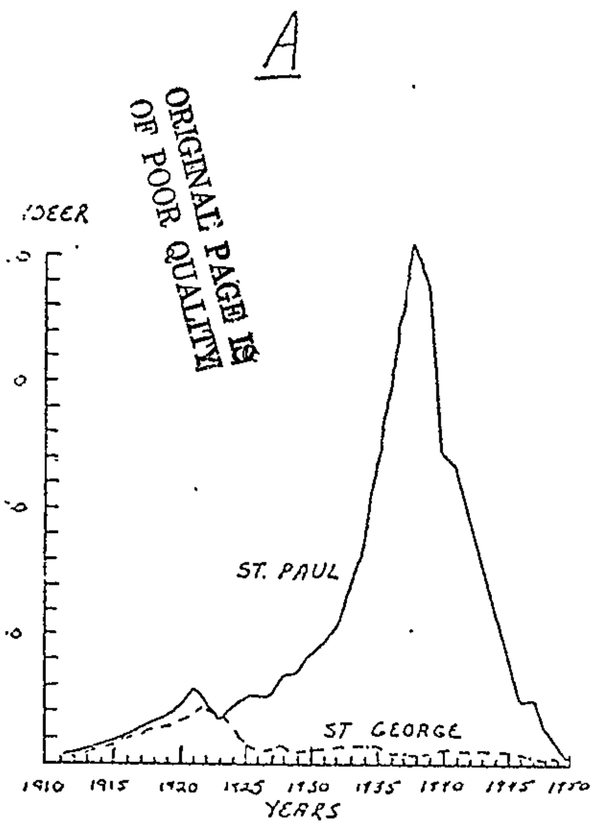
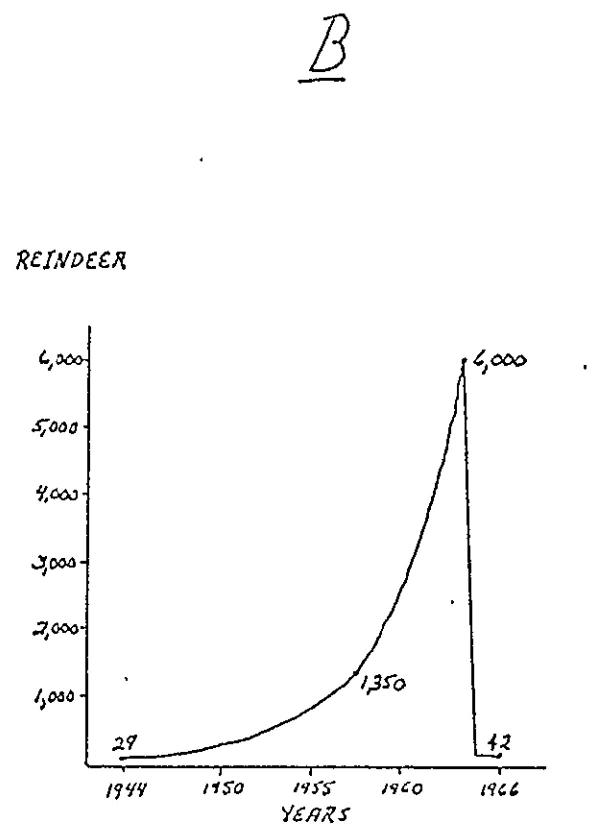
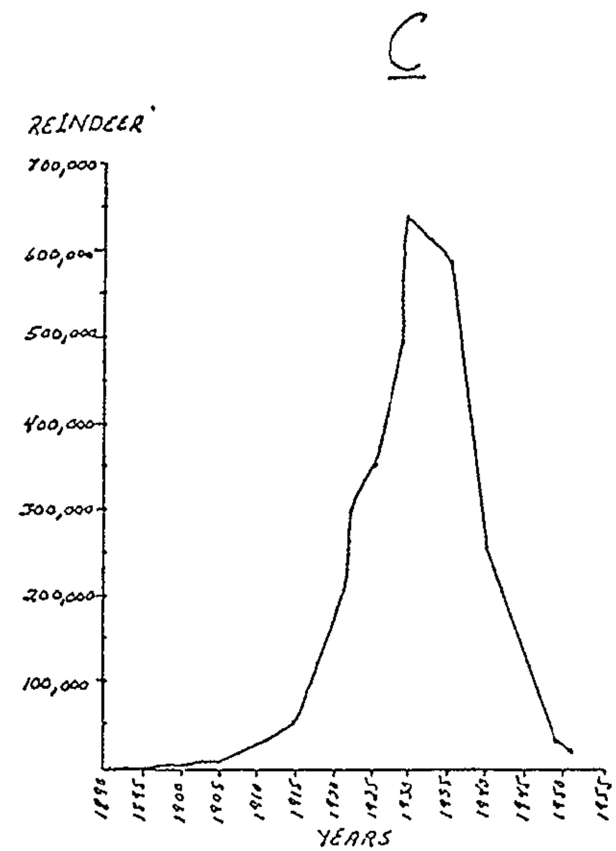


Reindeer populations of the Pribilof Islands from 1911 to 1950. (Each point represents the combined number of deer killed for food and spared or, in years when no animals were killed, the number of deer counted at the end of the year.) From: Scheffer, 1951.



Assumed population growth of the St. Matthew Island reindeer herd. Actual counts are indicated on the population curve. From: Klein, 1968.



A record of the increase and crash of reindeer in Alaska. From: Leopold + Fraser Darling, 1953.

> that a population of ungulates can graze or browse more than the annual increment on its range and still go on increasing and apparently thriving. The stockman tends to see the animals only and remains content if they increase and thrive. But the condition of the range, and particularly of the winter range, is the crucial matter in the management of ungulate populations, and the ecologist is only now training himself to analyze and correctly assess range condition. L. J. Palmer, who worked so long and well on the agronomy of reindeer pastoralism, recognized the situation too late to prevent the crash. Indeed, the increase of the herds was like a flood, and he could not possibly have stemmed the catastrophe during the last years of increase."

It is unfortunate that most of the former reindeer herders interviewed in the Calista region are willing to attribute the massive decline of the herds to wolf predation. As an exception, however, four exherders in Quinhagak - when interviewed together - presented the unanimous statement that their animals became thin and that most of them died from lack of food during the winter months. However, it is from island situations, where no wolves or other predators exist, that we find the most conclusive evidence that the rise and crash of reindeer populations can occur independently of predation. The graphs of Fig. 1 show the rise and fall of populations on (wolf-free) islands: A & B; and it is impossible to assume any major differences between these phenomena and that from the (wolf-inhabited) mainland: C.

Referring to St. Paul, Scheffer (1951) noted that the growth of lichens kept pace with the demand when the herd was small, but that following the crash, a diligent search was required to find representative specimens. Klein (1968), who made a systematic study of vegetation conditions on St. Mathew Island, concluded that the lichen (winter) ranges were seriously depleted by the overpopulating reindeer and that shortage of food, combined with severe winter conditions, resulted in the die-off.

The lesson to be learned from the history of these populations is simple, indeed. It faithfully mirrors the concept that populations of herbivorous animals may fluctuate widely - and to the ultimate disadvantage of their range and themselves - unless strong natural or artificial limiting factors can serve as a counter-action. In the case of reindeer, the counter-acting factor must be man, through the amount of harvest he takes. It is abundantly clear that the dramatic increase and decline of the western Alaska reindeer populations could have been prevented if the harvest levels had been adequate. It is also axiomatic that harvest levels should be continuously reviewed and adjusted to maintain the herds at generally stable levels. Further, that the herd levels must at all times be kept significantly below the (estimated) carrying capacity of the winter range. However, this rather simple concept demands a complex technology, and further requires the absolute cooperation of the herd owner himself.

FISH

The exploitation of fish resources has always been one of the most important activities of the people of the lower Yukon and Kuskokwim Rivers. These resources now provide the basis for commercial as well as subsistance fishing, but we do not expect the latter to diminish in importance for many decades to come. The bulk of the fisheries research in the Calista region has been that undertaken by the Alaska Department of Fish and Game on the various salmon species that constitute the commercially exploited runs of the Yukon and Kuskokwim rivers. In comparison, little work has been done on the non-salmon species or in the myriad of fish producing lakes of the region. Even so, we are aware of the fact that many of the lesser known species, such as whitefish, provide an important part of the subsistance needs of the people.

An understanding of the ecology and utilization of the migratory salmon will be necessary when Calista involves itself with problems of fish management. This report, however, is concerned with the geographical distribution of the non-salmon species because it is these fish which can be included in overall resource evaluations for specific units of land.

In view of the extremely large number of lakes, rivers and streams in the Calista region, adequately sampling the extent of fish populations cannot be accomplished in a single summer. It is difficult to confidently extrapolate the finding from one lake, even to nearby lakes with similar characteristics. It would require at least a decade of work to cover the major lakes and streams of the region, and even then many gaps would be present in the overall picture. A further problem arises when trying to evaluate relative abundance of fish, either inter-specifically within the same lake or intra-specifically between lakes. Although our sampling and that of the Alaska Fish and Game Department followed the same method (recording fish caught per species per net hour), the apparent abundances that result cannot be assured to represent real, relative abundances.

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