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SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND

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16. Abstract ERTS imagery provides sufficient resolution to discern two effects of geothermal activity at the Námafjall geothermal area: snowmelt anomalies and delineation of altered ground. The fallout pattern of tephra from Hekla's 1970 volcanic eruption can be mapped where sufficient depth of deposition destroyed the vegetation. Lava flows from the volcanic eruptions at Askja (1961) & Hekla (1970) can be delineated. Low sun-angle imagery (<10°) of snow-covered terrain has permitted the mapping of new structural and volcanic features beneath the icecaps. Coastline changes on the islands of Surtsey (erosion) and Heimaey (lava flows) can be mapped. Variations in sediment plumes from glacial rivers on the south coast give a qualitative indication of seasonal changes in melting rates of glaciers. ERTS imagery has been shown to be especially amenable to portrayal of changing glaciological phenomena: surging glaciers, collapse features in icecaps caused by subglacial volcanic (?) and geothermal activity and resulting jökulhlaups, and variations in size of glacier-margin lakes. A fifth vegetation class has now been added: lichen-covered bedrock. The high latitude of Iceland permits considerable stereoscopic coverage with relief features discernible to 100m, thus enabling more precise analysis of landforms, vegetation distribution, occurrence of snow cover, glaciers, and geologic structure.

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Unclassified	N/A	15	

Figure 2A. Technical Report Standard Title Page. This page provides the data elements required by DoD Form DD-1473, HEW Form OE-6000 (ERIC), and similar forms.

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Type II Progress Report
ERTS-1

a. Title: Satellite Geological and Geophysical Remote Sensing of Iceland

ERTS-A Proposal No.: SR 651

b. GSFC ID No. of P.I.: IN 079

c. Statement and explanation of <u>any</u> problems that are impeding the progress of the investigation:

Two problems still persist in reaching all of the research objectives of this experiment. The first is the discontinuous coverage of Iceland, which when combined with persistent cloudiness, limits usable cloud-free imagery of Iceland on a seasonal basis. For example, even though each area in Iceland is imaged 3 days in a row (because of orbital spacing at a latitude of 65°N.), and all of Iceland is imaged in 10 successive days every 18 days, in 1-1/2 years (1 September 1972 - 1 March 1974) of potential image acquisition, only 20 percent of the possible image-acquisition days were used. This does not count the months of December and January for 1972-1973 or 1973-1974. During this period there were about 220 days for possible data acquisition. There were 45 separate days of at least one image acquired which can be subdivided into 14 single days, 5 double-day sequences, 2 triple-day sequences, 1 quadruple-day sequence, and 2 quintuple-day sequences during these 1-1/2 months. Five frames (north to south) could have been collected each image-acquisition day for a potential total of 1100 frames. Only 10 percent of the total, 114 individual frames, were acquired or 51 percent of the potential total for 45 days of actual data acquisition. This can be subdivided into 16 days of 1 frame, 6 days of 2 frames, 8 days of 3 frames, 13 days of 4 frames, and 2 days of 5 frames. In addition, of the total of 114 individual frames, 52 (46 percent) are usable for analysis. Even with the limited coverage, however, usable imagery exists for each of the following months: September (4 frames), October (7 frames), and November (1 frame), 1972; January (2 frames), February (6 frames), March (7 frames), May (2 frames), July (8 frames), August (4 frames), September (4 frames), and October (6 frames), 1973. Although generally, only for four or five frames, all were acquired on the same day during one orbital pass.

Of 24 frames of different ERTS imagery which completely cover Iceland, in only 15 cases is there usable imagery which covers the same area more than once. Because it takes 29 different frames to completely cover Iceland, five areas, particularly in the northwestern part of the country, had no usable ERTS imagery ever acquired.

The reason for presenting all of this statistical data is to show the limited coverage of Iceland and the distribution of usable imagery. The absence or paucity of ERTS data of Iceland during the spring and early summer months (March, April, May, and June 1973) has impacted most severely on those experiments which lack data during the spring - when many aspects of the environment are undergoing dynamic environmental change (e.g., change in snowcover, vegetation growth, river flooding, sea ice buildup, etc.). The latter experiment was the most severely affected by less than maximum number of frames on orbital passes and minimal coverage of northwestern Iceland. This is because sea ice usually makes its closest approach to Iceland in the northwest, and because of the lack of coverage (limited number of frames) north of Iceland.

The limited coverage of Iceland was the result of a number of factors: tape recorder limitations, priorities assigned to other test sites, lack of timely weather data, restrictions on minimum sun angle necessary for data acquisition, and command-and-control limitations of the ERTS-1 spacecraft.

Even with all these limitations on acquisition of ERTS data of Iceland, I should like to point out that NDPF has done a superb job in scheduling the available imagery. NASA's Goddard Space Flight Center is to be commended for carrying out a difficult job and providing the data which has formed the basis for a number of new research findings from the Iceland experiment.

Some difficulty has developed in getting color composites from User Services. Requests made on Data Request Forms have been turned down because of "poor quality" of the imagery. Yet when I have ordered color composites of the same scenes from General Electric (Beltsville, Md.) to meet the research objectives of the experiment, superb color composites have been made for me. There is a problem here in defining "poor quality" which must be resolved. There also seems to be a deterioration in quality of color composites from NASA, particularly the preparation of transparencies and prints which are far too dark, thus masking important data. The color composites have been very important to many of the results from the Iceland experiment. It appears that someone in NASA has come to the totally erroneous, ill-conceived, and unfortunate conclusion that color composites are of little value. Nothing could be farther from the truth. Improvement in quality of color composites is a must!

d. Discussion of the accomplishments during the reporting period and those planned for the next reporting period:

1. Most of the reporting period was directed at analysis of data, presentation of results to different forums, and preparation of papers for publication. All ERTS-1 imagery of Iceland, which was acquired during the reporting period has been catalogued, annotated, and studied.

2. Papers were presented before four different scientific groups: a) presentation of research findings before the special NASA review of the status of experiments for each ERTS-1 investigator (Oct. 1973); b) presentation of the initial results of the ERTS experiment in Iceland before the National Academy of Sciences' Committee on Polar Research (Oct. 1973); c) presentation of a paper on the geological importance of ERTS imagery of Vatnajökull, Iceland, to the Geological Society of America Annual Meetings (Nov. 1973); d) presentation of preliminary results of the ERTS experiment of Iceland before the American Society of Photogrammetry's Symposium on Management and Utilization of Remote Sensing Data (Oct. 1973).

3. Summaries were submitted and papers are under preparation for the Ninth International Symposium on Remote Sensing of Environment (Apr. 1974) and the International Society of Glaciology's Symposium on Remote Sensing in Glaciology (Sep. 1974).

4. Two lectures on ERTS were presented to the Department of Geology, State University of New York (College at Cortland) (Nov. 1973), and one lecture to the American-Scandinavian Foundation on the value of ERTS to environmental studies of Iceland (Feb. 1974).

5. Two days were spent at Johnson Space Center, Houston, Texas, reviewing all of the color and color infrared aerial photography and aerial thermography of Iceland which was acquired in August 1973. Analysis of the aerial data will be incorporated into the analysis of ERTS imagery later in the project. As a result of this trip, a two-day trip was made to Lamont Geological Observatory to meet with Dr. Guðmundur Pálmason, one of the Icelandic co-investigators, who is on a visiting professorship to Columbia University. A review of the aerial photography, aerial thermography, and ERTS imagery was carried out at that time.

6. One day visits to the EROS Program of the U. S. Geological Survey were made by Prof. Magnús Magnússon, Director of the University of Iceland's Science Institute in Reykjavík, Iceland, and Mr. Steingrímur Hermannsson, M. P., and Director of the (Icelandic) National Research Council, in January and February, respectively, to review the status of and progress with the ERTS project in Iceland. Tentative plans were made to hold a remote sensing seminar in Iceland later in the year on the basis of research results from the ERTS imagery and with other remotely sensed data (aerial photography and thermography, weather satellite imagery, etc.) resulting from the principal investigator's geological remote sensing research projects in Iceland, beginning in 1966.

7. Special black and white and color enlargements were made of selected ERTS images of Iceland and distributed to the co-investigators for analysis. Enlargements were made to exact 1:500,000 and 1:250,000 scales from NDPF negatives (3rd generation). Special black and white enlargements (as much as 1:84,225) have been made of certain phenomena of Iceland for comparison with depiction of such features on published maps. Good results on coastal features and glaciological features, because of their high contrast [e.g., waves breaking on coast of island or along coast (white fringe separating dark water from dark beach), bright white of glaciers when compared with surrounding terrain] has been achieved.

8. For the next, and final six months of the ERTS-1 experiment of Iceland, emphasis will be placed on preparation of scientific papers and orthoimage maps of Iceland. Research emphasis will be placed on the mapping of glaciological phenomena. The following activities, including trips, will be carried out during the next six months:

a) Preparation of a paper, "Environmental Studies of Iceland with ERTS-1 Imagery," for the Ninth Environmental Symposium on Remote Sensing of Environment, University of Michigan, Ann Arbor, Michigan (15-19 Apr. 1974).

b) Preparation of a paper, "Glaciological Studies in Iceland with ERTS-1 Imagery," for the International Society of Glaciology's Symposium on Remote Sensing in Glaciology, Cambridge, England (16-20 Sep. 1974).

c) Participation in a NATO Advanced Study Institute, "Geodynamics of Iceland and the North Atlantic Area," Reykjavík, Iceland. Also research with Icelandic co-investigators. (30 Jun. - 13 Jul. 1974).

d) Member of a glaciological expedition onto Vatnajökull (icecap) to make field observations of glaciological features mapped on ERTS-1 imagery. Also research with Icelandic co-investigators. (29 May - 8 June 1974).

e) Presentation of "Iceland Seminar and Workshop on Remote Sensing of the Environment," in Reykjavík, Iceland, with particular emphasis on the use of ERTS-1 imagery to the monitoring of the natural resources and environment of Iceland. Also research with Icelandic co-investigators. (3-12 Sep. 1974).

f) Preparation of a false-color (MSS), uncontrolled, orthoimage mosaic of Iceland (1:1,000,000-scale).

g) Preparation of 1:250,000-scale controlled, orthoimage mosaic maps of the largest icecaps in Iceland (3 sheets, contiguous to each other) in association with the Icelandic Geodetic Survey (Landmælingar Íslands).

h) Preparation of 1:500,000-scale, controlled, orthoimage mosaic map of Iceland in 3 types: band 5 (summer), band 7 (summer), and band 7 (winter) in association with the Icelandic Geodetic Survey (Landmælingar Íslands).

e. Discussion of significant scientific results and their relationship to practical applications or operational problems including estimates of the cost benefits of any significant results:

ERTS imagery provides sufficient resolution to discern two effects of geothermal activity at the Námafjall geothermal area: snowmelt anomalies and, on MSS color composites, delineation of altered ground. The primary axes of the fallout pattern of tephra from Hekla's 1970 volcanic eruption can be mapped where sufficient depth of deposition destroyed the vegetation. Lava flows from Askja's 1961 volcanic eruption and Hekla's 1970 volcanic eruption, and new land created by the 1973 volcanic eruption on Heimaey can be mapped. Low sun-angle imagery ($<10^\circ$) of snowcovered terrain has permitted the mapping of new structural and volcanic features beneath the glacial ice in the active zones of Iceland. Coastline changes on the islands of Surtsey (erosion) and Heimaey (before, during, and after cessation of volcanic activity) can be mapped from 1:100,000-scale enlargements. The changing size of sediment plumes from glacial rivers on the south coast give a qualitative indication of seasonal changes in melting rates of glaciers. ERTS imagery has been shown to be especially amenable to portrayal of the entire areal extent of most glaciers and icecaps at different points in time, thereby accurately showing changes with time of glaciological phenomena. Surging glaciers, collapse features in icecaps caused by subglacial volcanic (?) and geothermal activity and resulting jökulhlaups, and variations in size of glacier-margin lakes have all been successfully mapped in Iceland from ERTS imagery. In addition to the previous delineation of four distinct vegetation types on MSS color composites (forested areas, cultivated areas, grasslands, and reclaimed areas) and barren areas (absence of color), a fifth vegetation class has been added: lichen-covered bedrock. The high latitude of Iceland permits considerable stereoscopic coverage on side-lapping ERTS imagery with features with relief as little as 100 m discernible. This ability to study landforms, vegetation distribution, occurrence of snowcover, glaciers, and geologic structure stereoscopically generally permits a more precise analysis to be made of these phenomena. [1C, 2D, 2I (photogrammetry), 3C, 3F, 3I, 3K, 4D, 4G, 4H, 5D, 5H, 10A (Iceland)]

f. A listing of published articles, and/or papers, preprints, in-house reports, abstracts of talks, that were released during the reporting period:

Papers Published

Williams, R. S., Jr., Böðvarsson, Ágúst, Friðriksson, Sturla, Pálmason, Guðmundur, Rist, Sigurjón, Sigtryggsson, Hlynur, Sæmundsson, Kristján, Thorarinsson, Sigurður, and Thorsteinsson, Ingvi, 1973, Iceland: Preliminary results of geologic, hydrologic, oceanographic, and agricultural studies with ERTS-1 imagery: in Proceedings of Symposium on Management and Utilization of Remote Sensing Data, American Society of Photogrammetry, Sioux Falls, South Dakota, p. 17-35.

Williams, R. S., Jr., and Pálmason, Guðmundur, 1973, Námafjall geothermal area, Iceland: Preliminary analysis of ERTS-1 image #1229-12142: Special Report No. 1 to NASA, Goddard Space Flight Center, Greenbelt, Md., under ERTS-1 experiment SR 651, Satellite Geological and Geophysical Remote Sensing of Iceland, 5 p.

Williams, R. S., Jr., Böðvarsson, Ágúst, Friðriksson, Sturla, Pálmason, Guðmundur, Rist, Sigurjón, Sigtryggsson, Hlynur, Sæmundsson, Kristján, Thorarinsson, Sigurður, and Thorsteinsson, Ingvi, 1973, Iceland: Preliminary results of geologic, hydrologic, oceanographic, and agricultural studies with ERTS-1 imagery: Special Report No. 2 to NASA, Goddard Space Flight Center, Greenbelt, Md., under ERTS-1 experiment SR 651, Satellite Geological and Geophysical Remote Sensing of Iceland; Reprint of paper published in Proceedings of Symposium on Management and Utilization of Remote Sensing Data, American Society of Photogrammetry (1973), p. 17-35.

Williams, R. S., Jr., Thorarinsson, Sigurður, and Sæmundsson, Kristján, 1973, Vatnajökull area, Iceland: New volcanic and structural features on ERTS-1 imagery: Special Report No. 3 to NASA, Goddard Space Flight Center, Greenbelt, Md., under ERTS-1 experiment SR 651, Satellite Geological and Geophysical Remote Sensing of Iceland; Reprint of abstract published in Geological Society of America Abstracts with Programs, 1973 Annual Meetings, v. 5, no. 7, October, p. 864-865.

Papers in Press

Williams, R. S., Jr., and Thorarinsson, Sigurður, 1973, ERTS-1 image of Vatnajökull area: General comments: Jökull, v. 23, (in press).

Thorarinsson, Sigurður, Sæmundsson, Kristján, and Williams, R. S., Jr., 1973, ERTS-1 image of Vatnajökull: Analysis of glaciological, structural, and volcanic features: Jökull, v. 23 (in press).

Williams, R. S., Jr., Böðvarsson, Ágúst, Friðriksson, Sturla, Pálmason, Guðmundur, Rist, Sigurjón, Sigtryggsson, Hlynur, Sæmundsson, Kristján, Thorarinsson, Sigurður, and Thorsteinsson, Ingvi, 1974, Environmental Studies of Iceland with ERTS-1 imagery (abs.): in Summaries of Ninth Symposium on Remote Sensing of Environment, Univ. of Mich., Ann Arbor, Mich., (in press)

Williams, R. S., Jr., Böðvarsson, Ágúst, Friðriksson, Sturla, Pálmason, Guðmundur, Rist, Sigurjón, Sigtryggsson, Hlynur, Sæmundsson, Kristján, Thorarinsson, Sigurður, and Thorsteinsson, Ingvi, 1974, Environmental Studies of Iceland with ERTS-1 imagery: in Proc. Fifth Symposium on Remote Sensing of Environment, Univ. of Mich., Ann Arbor, Mich., (in press)

Williams, R. S., Jr., Böðvarsson, Ágúst, Rist, Sigurjón, Sæmundsson, Kristján, and Thorarinsson, Sigurður, 1974, Glaciological studies in Iceland with ERTS-1 imagery: in Summaries of Symposium on Remote Sensing in Glaciology, Intl. Glaciol. Soc., Cambridge, England (in press)

Presentations

Williams, R. S., Jr., 1973, Potential usefulness of satellite imagery for the study of rift zones, with particular reference to Iceland: Meeting of Inter-Union Commission of Geodynamics, Rpt. of Working Group 4 Meeting, Session on Reviews of State of Knowledge Regarding Iceland and Neighborhood, Reykjavík, Iceland, 16 July.

Williams, R. S., Jr., 1973, Interim results from ERTS-1 experiment, "Satellite geological and geophysical remote sensing of Iceland:" Report presented to the Geology Review Panel of NASA's Goddard Space Flight Center, Greenbelt, Maryland, 24 October.

Williams, R. S., Jr., 1973, USGS Iceland imagery survey: Lecture presented to Committee on Polar Research, National Academy of Sciences (NRC), as one of 7 papers on "ERTS Imagery in Arctic Regions," Boulder, Colorado, 26 October.

Williams, R. S., Jr., Boðvarsson, Ágúst, Friðriksson, Sturla, Pálmason, Guðmundur, Rist, Sigurjón, Sigtryggsson, Hlynur, Sæmundsson, Kristján, Thorarinsson, Sigurður, and Thorsteinsson, Ingvi, 1973, Iceland: Preliminary results of geologic, hydrologic, oceanographic, and agricultural studies with ERTS-1 imagery: Symposium on Management and Utilization of Remote Sensing Data, American Society of Photogrammetry, Sioux Falls, South Dakota, 30 October.

Williams, R. S., Jr., Thorarinsson, Sigurður, and Sæmundsson, Kristján, 1973, Vatnajökull area, Iceland: New volcanic and structural features on ERTS-1 imagery: Geological Society of America, 1973 Annual Meetings, Dallas, Texas, 14 November.

Williams, R. S., Jr., 1973, Iceland: Preliminary results of geologic, hydrologic, oceanographic, and agricultural studies with ERTS-1 imagery: Lecture presented to Department of Geology, State University of New York (College at Cortland), Cortland, New York, 29 November.

Williams, R. S., Jr., 1973, ERTS-1: A new window on our planet: Lecture presented to Department of Geology, State University of New York (College at Cortland), Cortland, New York, 29 November.

Williams, R. S., Jr., 1974, Environmental Studies of Iceland from Space: Lecture presented to the Washington, D. C. Chapter of the American-Scandinavian Foundation, St. John's Episcopal Church, Chevy Chase, Maryland, 13 February.

g. Recommendation concerning practical changes in operations, additional investigative effort, correlation of effort and/or results as related to maximum utilization of the ERTS system:

The repetitive ERTS-1 imagery (MSS) acquisition over Iceland has created a large cataloging problem. For that reason a geographic matrix for Iceland was created. The attached revised and updated matrix shows how each image (and repetitive images of the same area) has been arbitrarily given a specific geographic name. Successive images differ only in their date (season) and in the amount of cloud cover (obscuration).

I have also enclosed a table showing the dates of potential 1974 coverage of Iceland with the ERTS-1 satellite. As I have noted previously, the arbitrary geographic matrix for ERTS-1 imagery of Iceland becomes a series of "quadrangle maps," easily correlative with existing map and aerial photographic coverage. NASA should consider holding the orbit more closely over time (more frequent correction) and holding the "framing" to the same area. In this way successive ERTS-1 (for a specific satellite) images would become "maps" of specific areas. The study of dynamic phenomena could be more easily carried out, particularly computer-assisted "change-detection" mapping.

I would also like to reiterate another recommendation to NASA for maximum use of the ERTS spacecraft in geologic studies. One of the best ERTS images of Iceland was acquired in mid-winter, when the ground was snow covered, and the sun angle was 7°. Subtle details of geologic structure and volcanic landforms, both within and outside the margins of icecaps, were revealed. NASA should give strong consideration to acquiring ERTS imagery, under low sun angle conditions (down to 5° or even less) at high latitudes. Either mid-winter or on an ascending (evening) orbit during mid-summer (1 June to 1 August) in Iceland would produce low-sun angle imagery of great value to structural and geomorphic studies.

Although it is probably too late to be incorporated into the ERTS-1 data acquisition procedures, a major improvement in getting more timely weather data for ERTS-2 should be sought. Closer association with NOAA would perhaps be desirable in planning data acquisition over foreign areas. Not only would more timely weather data permit more cloud-free coverage of foreign areas, but it would also result in more imagery as well.

Future ERTS spacecraft (post-ERTS-2) should have a greater command-and-control capability, particularly for stored commands, and greater tape recorder capability to assure maximum coverage of foreign areas. Repetitive coverage of most foreign areas has been quite low compared with North America (tape recorder, command-and-control, and advance weather data limitations vs. real-time data acquisition). This is probably causing a very real bias in the results of research with ERTS imagery.

One of the great advantages of the ERTS spacecraft, a capability not equalled by any other satellite, civilian or military, is the systematic routine and repetitive coverage with high-resolution imagery of North America. While this extraordinary capability is being exploited over North America spacecraft limitations are preventing, in most cases, coverage of dynamic phenomena outside the United States. In most areas one-time, cloud-free coverage is the best that can be hoped for. It will probably require data from ERTS-2 to emphasize the great value of ERTS to record dynamic change of environmental phenomena, not just in North America, but throughout the globe. I suspect that this capability of ERTS will be underrepresented on ERTS-1 reports of areas outside North America. I suspect that even for North American studies, contract periods may have expired before new data on environmental change could be incorporated into final reports. One of the aspects of the Iceland experiment, and somewhat disconcerting, is that available imagery of a particular area was always being changed by new and different views. No two views of the same area were ever quite the same. I'm certain that this ability to study an area which is undergoing constant change requires an entirely new approach to scientific analysis of environmental phenomena. It will be some time, I expect, before the procedures and methodology to evaluate dynamic phenomena will be fully developed simply because environmental scientists have never had such research opportunities before.

h. A listing by date of any changes in Standing Order Forms:

None

i. ERTS Image Descriptor Forms:

Thirty-three forms (24 new) are provided as an attachment to this report.

j. Listing by date of any changed Data Request Forms submitted to Goddard Space Flight Center/NDPF during the reporting period:

A request for black and white prints and for color composites and prints was ordered on Data Request Forms which were submitted to Fred Gordon on 2 January 1974. Some difficulty has arisen with orders for color composites in that some have not been received. Because of the need to meet research objectives, funds have been spent to have some of the missing color composites made up by General Electric (Beltsville, Md.). Good results have been obtained from GE, even when User Services has stated that the imagery is of "too poor quality" to be made into a color composite.

NDPF Computer Abscissa

NDPF Computer Ordinate	133	119	105	91	77	63	49	35	21	7	Iceland Project Ordinate
13	A1	A2	A3 KOLBEINSEY	A4	A5 SLÉTTUGRUNN	A6	A7 ÞISTIL-FJARÐAR-GRUNN	A8	A9	A10	A
14	B1	B2	B3 SKAGI	B4 EYJAFJÖRÐUR	B5 TJÖRNES	B6 AXARFJÖRÐUR	B7 MELRAKKAS-LÉTTA	B8 LANGANES	B9 LANGANES-GRUNN	B10	B
15	C1 BREIÐA-FJÖRÐUR	C2 GLÁMA	C3 HVAMMS-FJÖRÐUR	C4 LANGJÖKULL	C5 AKUREYRI	C6 MÝVATN	C7 ÓDÁÐAHRAUN	C8 LAGARFLJÓT	C9 SEYÐIS-FJÖRÐUR	C10 GLETTINGA-NES	C
16	D1 JÖKUL-DJÚP	D2 FAXAFLÓI	D3 REYKJAVÍK	D4 ÞING-VALLAVATN	D5 HEKLA	D6 ÞÓRISVATN	D7 VATNAJÖKULL	D8 INGÓLFS-HÖFÐI	D9 HÖFN	D10	D
17	E1 ELDEYJAR-GRUNN	E2 REYKJANES-HRYGGURINN	E3 SKERJADJÚP	E4 GRINDA-VÍKURDJÚP	E5 SURTSEY	E6 VEST-MANNAEYJAR	E7 VÍK	E8 KÚÐAFLJÓT	E9	E10	E
18	F1 ATLANTS-HAF(SV)	F2	F3	F4	F5	F6	F7	F8 SKAFTÁRDJÚP	F9	F10	F
	1	2	3	4	5	6	7	8	9	10	

Iceland Project Abscissa

1 January 1974

Iceland ERTS-1 Data Acquisition Matrix

GEOGRAPHIC NAMES FOR ERTS-1 IMAGERY OF ICELAND

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ICELAND

Potential 1974 Coverage with ERTS-1

(5 Frames North-to-South: 13-17)
(10 Orbits East-to-West: 7, 21, 35, 49, 63, 77, 91, 105, 119, 133)

7	(EAST) 21	35	49	63	77	91	105	119	(WEST) 133
23 Jan	24 Jan	25 Jan	26 Jan	27 Jan	28 Jan	29 Jan	30 Jan	31 Jan	1 Feb
10 Feb	11 Feb	12 Feb	13 Feb	14 Feb	15 Feb	16 Feb	17 Feb	18 Feb	19 Feb
28 Feb	1 Mar	2 Mar	3 Mar	4 Mar	5 Mar	6 Mar	7 Mar	8 Mar	9 Mar
18 Mar	19 Mar	20 Mar	21 Mar	22 Mar	23 Mar	24 Mar	25 Mar	26 Mar	27 Mar
5 Apr	6 Apr	7 Apr	8 Apr	9 Apr	10 Apr	11 Apr	12 Apr	13 Apr	14 Apr
23 Apr	24 Apr	25 Apr	26 Apr	27 Apr	28 Apr	29 Apr	30 Apr	1 May	2 May
11 May	12 May	13 May	14 May	15 May	16 May	17 May	18 May	19 May	20 May
29 May	30 May	31 May	1 Jun	2 Jun	3 Jun	4 Jun	5 Jun	6 Jun	7 Jun
16 Jun	17 Jun	18 Jun	19 Jun	20 Jun	21 Jun	22 Jun	23 Jun	24 Jun	25 Jun
4 Jul	5 Jul	6 Jul	7 Jul	8 Jul	9 Jul	10 Jul	11 Jul	12 Jul	13 Jul
22 Jul	23 Jul	24 Jul	25 Jul	26 Jul	27 Jul	28 Jul	29 Jul	30 Jul	31 Jul
9 Aug	10 Aug	11 Aug	12 Aug	13 Aug	14 Aug	15 Aug	16 Aug	17 Aug	18 Aug
27 Aug	28 Aug	29 Aug	30 Aug	31 Aug	1 Sep	2 Sep	3 Sep	4 Sep	5 Sep
14 Sep	15 Sep	16 Sep	17 Sep	18 Sep	19 Sep	20 Sep	21 Sep	22 Sep	23 Sep
2 Oct	3 Oct	4 Oct	5 Oct	6 Oct	7 Oct	8 Oct	9 Oct	10 Oct	11 Oct
20 Oct	21 Oct	22 Oct	23 Oct	24 Oct	25 Oct	26 Oct	27 Oct	28 Oct	29 Oct
7 Nov	8 Nov	9 Nov	10 Nov	11 Nov	12 Nov	13 Nov	14 Nov	15 Nov	16 Nov
Eastern Iceland				Mid-Iceland			Western Iceland		

Richard S. Williams, Jr.
U. S. Geological Survey
13 February 1974

ERTS IMAGE DESCRIPTOR FORM

(See Instructions on Back)

DATE 1 November 1973

PRINCIPAL INVESTIGATOR Richard S. Williams, Jr.

GSFC IN 079

ORGANIZATION U. S. Geological Survey

NDPF USE ONLY
D
N
ID

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1372-12080-4 1372-12080-5 1372-12080-7				EEO Active Glacier Advancing Shoreline EEO Braided Streams Lake Cinder Cone Coast Coastal Plain Coastline Crater EEO Lateral Moraines EEO End Moraines EEO Medial Moraines Fault Lava EEO Glacier Littoral Drift Maar Moraine Nunatak EEO Outwash Plain Sediment Snow Vegetation Volcano Bay Baymouth Bar Cape Cartography Desert Grassland Highway Lagoon Morainal Lake

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1372-12080-B				Rangeland Forest Littoral Drift Pasture Sediment Vegetation Reclamation Test Plot Glacier Margin Lakes
1372-12074-5 1372-12074-7				Active glacier (surging) Caldera Cartography Crater Medial Moraine Glacier Grassland Lake Moraine Mountain Outwash Plain River Sediment Snow Snow Pack Vegetation Volcano Desert Island Lava
1372-12074-B				Rangeland

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1372-12083-4				EEO Active Glacier
1372-12083-5				Advancing Shoreline
1372-12083-7				Braided Stream
				EEO Caldera
				EEO Lateral Moraines
				Coast
				Coastal Plain
				Coastline
				Crater
				End Moraine
				Grassland
				EEO Glacier
				Cartography
				Cape
				EEO Moraine
				EEO Outwash Plain
				Snow
				Lake
				Maar
				Moraine
				Nunatak
				Sediment
				Vegetation
				Bay
				Baymouth Bar
				Highway
1372-12083-B				Rangeland
				Forest
				Littoral Drift
				Pasture
				Sediment
				Vegetation
				Morainal Lake
				Reclamation Test Plot

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1392-12182-5 1392-12182-7 1392-12182-B				Cape Coast Coast Line EEO Crater (Shield Volcano) EEO Fault (Transform) Rift Fracture Zone Fiord Floodplain Grassland Harbor Highway Island Lake Lava Dunes EEO Mountain (Móberg) Pasture Peninsula Rangeland River Advancing shoreline Snow Snowpack Vegetation Volcano

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1392-12185-4 1392-12185-5 1392-12185-6 1392-12185-7 1392-12185-B (Continued)				EEO Active Glacier Caldera EEO Crater Forest EEO End Moraine Fault Floodplain Geology Geothermal Area (Altered ground) Glacier Cape EEO Cirques Lakes EEO Moraine EEO Nunatak River Snow Volcano Snowpack Dunes Advancing Shoreline Bays EEO Baymouth Bar Coast Coast line EEO Ice Caps EEO Mountain (Móberg) Desert Fiord Grassland Rangeland Pasture Highway Harbor

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1392-12185-4 1392-12185-5 1392-12185-6 1392-12185-7 1392-12185-B				Island Lagoon Lava Littoral Drift Peninsula Sediment Vegetation

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1392-12191-4 1392-12191-5 1392-12191-6 1392-12191-7 1392-12191-B (Continued)				EEO Active Glacier Advancing Shoreline EEO Braided Stream EEO Caldera Cinder Cone Coast Coastal Plain Coastline EEO Crater EEO End Moraine Fault Lake EEO Glacier (Ice Cap) Graben EEO Moraine EEO Outwash Plain Snow EEO Volcano EEO Active Volcano Lava EEO Tectonic Fissures (Gjá) Snowpack EEO Snowline Cape Peninsula Cartography Island EEO Vegetation Grassland Rangeland Pasture EEO Tephra (Volcano Ash) Fallout Pattern Sediment

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1392-12191-4				Rift Zone
1392-12191-5				EEO Nunatak
1392-12191-6				Morainal Lake
1392-12191-7				Littoral Drift
1392-12191-B				Lagoon
				Highway
				EEO Geothermal area
				EEO Shield Volcano
				EEO Móberg Ridges
				Fiord
				Desert
				Forest
				EEO Bayhead Bar
				Harbor
				Bay
				Dune
				Coastal Dunes

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1392-12194-5 1392-12194-6 1392-12194-B				Advancing shoreline Cape Cartography Cinder cone Crater Island Lava Volcano

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1304-12315-4 1304-12315-5 1304-12315-7				Bay Baymouth Bar River Coast Lake Lagoon Marsh Pasture Peninsula Grassland

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1304-12310-5 1304-12310-7				Ice Floe

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
*(1048-12082-4) *(1048-12082-5) *(1048-12082-7) *(1048-12082-B) *Partial image only. No actual number exists. I've assigned a fictitious number to it.				EEO Active Glacier Advancing Shoreline Braided Stream Caldera EEO Lateral Moraine Coast Coastal Plain Coastline Crater EEO End Moraine Grassland Cartography EEO Glacier Sediment Maar EEO Moraine EEO Outwash Plain Snow Lake Cape Nunatak Vegetation Bay Baymouth Bar Highway Rangeland Forest Littoral Drift Pasture Sediment Morainal Lake Reclamation Test Plot

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
*(1083-12023-4) *(1083-12023-5) *(1083-1202307) *(1083-12023-B) *Partial image only. No actual number exists. I've assigned a fictitious number to it.				EEO Active Glacier (Ice cap) EEO Advancing Glacier EEO Surging Glacier Braided Stream Moraine Outwash Plain Snow Grassland Rangeland Pasture Bay Harbor Baymouth Bar Cape Cartography Coast Coastal Plain Coast Line Desert EEO Medial Moraine EEO Glacier Lagoon Lake Littoral Drift Sediment EEO Morainal Lake EEO Glacier Margin (Ice-dammed) Lake River Vegetation

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1229-12145-4				EEO Active Glacier
1229-12145-5				EEO Caldera
1229-12145-6				EEO Crater
1229-12145-7				Echelon Fault
				EEO End Moraine
				Fault
				Frozen Lake
				Geology
				Geothermal Area
				Glacier
				Graben
				Ice
				EEO Moraine
				EEO Nunatak
				River
				Snow
				Volcano
				Coast
				Coastal Plain
				Coast Line
				Cinder Cone
				Highway
				Ice-Dammed Lake
				EEO Outwash Plain
				Rift Zone
				EEO Crater Row
				EEO Móberg Ridges

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1195-12262-4 1195-12262-5				Volcano Island

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1194-12195-7				EEO Crater in Shield Volcano Tectonic Fissures (Gjár) River

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1088-12312-4 1088-12312-5 1088-12312-6 1088-12312-7 1088-12312-B				Baymouth Bar Braided Stream Cape Coast Coastal Dune Coast Line Tectonic Fissures (Gjá) Harbor Lake Highway Lagoon Littoral Drift Snow Pasture Vegetation Grassland Rift Zone River Sediment

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1086-12195-5 1086-12195-7 1086-12195-B				Active Glacier Caldera Crater Glacier Rangeland Lake EEO Lava Morainal Lake Snow Volcano

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1462-12054-7				Caldera Lake Snow

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1372-12080-4 1372-12080-5 1372-12080-7				EEO Active Glacier Advancing Shoreline EEO Braided Streams Lake Cinder Cone Coast Coastal Plain Coast Line EEO Crater EEO Lateral Moraines EEO End Moraines EEO Medial Moraines Fault Lava EEO Glacier Littoral Drift Maar Moraine Nunatak EEO Outwash Plain Sediment Snow Vegetation Volcano Bay EEO Baymouth Bar Cape Cartography Desert Grassland Highway Lagoon Morainal Lake EEO Rift Zone

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1372-12080-4 1372-12080-5 1372-12080-7				Harbor EEO Outlet Glaciers River EEO Geothermal Area EEO Caldera EEO Ice Cap Rangeland Forest Pasture Reclamation Test Plot EEO Glacier Margin Lake EEO Ice-Dammed Lake EEO Surging Glacier EEO Snow Line

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1426-12073-4 1426-12073-5 1426-12073-7 1426-12073-B				EEO Active Glacier Advancing Shoreline Braided Stream Caldera EEO Lateral Moraines Coast Coastal Plain Coast Line Crater End Moraine Grassland EEO Glacier Cartography Cape EEO Moraine EEO Outwash Plain Snow Lake Maar Moraine Nunatak Sediment Vegetation Bay Baymouth Bar Highway Rangeland Forest Littoral Drift Pasture Sediment Vegetation Morainal Lake Reclamation Test Plot

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1426-12064-4 1426-12064-5 1426-12064-6 1426-12064-7 1426-12064-B				EEO Active Glacier EEO Móberg Mountain Braided Stream EEO Caldera Desert Coast Coastal Plain Coastline EEO Crater End Moraine Vegetation Sediment EEO Glacier River Rangeland EEO Moraine Outwash Plain Snow Volcano EEO Advancing Glacier EEO Lava Cape Cartography Grassland Lake Littoral Drift EEO Ice Margin Lake Geothermal Area Dune Snowpack

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DATE 1 March 1974

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ORGANIZATION U. S. Geological Survey

PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1249-12260-5 1249-12260-6 1249-12260-7				Bay Head Bar Bay Head Beach Cape Coast Coast Line Dormant Vegetation Fiord Frozen Lake Harbor Ice Lake Lagoon Peninsula River Snow

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1356-12194-4 1356-12194-5 1356-12194-6 1356-12194-7				Active glacier Advancing shoreline Braided Stream Cartography Coast Coastal Plain Coast Line Peninsula End Moraine Glacier Grassland Lagoon Lake Littoral Drift Morainal Lake Moraine Mountain EEO Nunatak Outwash Plain River Sediment Snow Snow Pack Vegetation Rangeland Pasture Baymouth Bar Coastal Dune

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1356-12192-5 1356-12192-7				Active Glacier Cape Peninsula Coast Coast Line Fiord Lake Geology Island Glacier River Snow
1356-12192-B				Rangeland Grassland Vegetation

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1356-12185-4 1356-12185-5 1356-12185-6 1356-12185-7				Bay Bay Head Beach Braided Stream Cape Coast Coast Line Rangeland Harbor Island Lagoon Lake Littoral Drift Peninsula River Sediment Snow

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1449-12351-4 1449-12351-5 1449-12351-6 1449-12351-7				Bay Baymouth Bar Crater Coast Coast Line Lake Lagoon Marsh Mountain Nunatak Pasture Peninsula Highway Snow EEO Stratovolcano Glacier Volcano

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1449-12344-4 1449-12344-5 1449-12344-6 1449-12344-7				Bayhead Bar Bay Cape Coast Coastal Plain Coast Line Crater Fiord Glacier Island Kelp Lagoon Lake Marsh Nunatak Pasture Peninsula Highway Snow Volcano

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1446-12180-5 1446-12180-7				EEO Volcano Advancing Shoreline Harbor Bay Cape Coast Coast Line Crater Vegetation Island Lava

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1446-12180-4 1446-12180-5 1446-12180-6 1446-12180-7				EEO Active Glacier Advancing Shoreline EEO Braided Stream EEO Caldera Maar Coast Coastal Plain Coast Line EEO Crater EEO End Moraine Nunatak River EEO Glacier Vegetation Littoral Drift EEO Moraine Snow EEO Volcano Sediment Lagoon Baymouth Bar Bay Harbor Flood Plain Grassland Rangeland Pasture Highway Island Lava

*FOR DESCRIPTORS WHICH WILL OCCUR FREQUENTLY, WRITE THE DESCRIPTOR TERMS IN THESE COLUMN HEADING SPACES NOW AND USE A CHECK (✓) MARK IN THE APPROPRIATE PRODUCT ID LINES. (FOR OTHER DESCRIPTORS, WRITE THE TERM UNDER THE DESCRIPTORS COLUMN).

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1446-12173-7				Caldera Cape Cirque EEO Hanging Valley Coast Coast Line Crater EEO Crater (Tephra Ring) EEO Móberg Mountain Lake EEO Geothermal Area (Snow melt pattern) Glacier Island Lagoon Peninsula Snow

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1431-12351-7				Fiord Coastline Snow Kelp Island Coast

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PRODUCT ID (INCLUDE BAND AND PRODUCT)	FREQUENTLY USED DESCRIPTORS*			DESCRIPTORS
1432-12405-5 1432-12405-6 1432-12405-7				Fiord Coastline Snow Kelp Island Lagoon Cape Coast Glacier Highway

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