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A Catalog System for Remote-Sensing Data

The manual card system effectively fulfills its purpose.

Introduction

In the past decade various research projects at the University of Wisconsin at Madison have produced thousands of low-altitude (about 10,000 ft or less) aerial photographs, hundreds of feet of thermal-scanning data, hundreds of simultaneously taken ground-truth water samples, and several hundred feet of high-altitude (over 40,000 ft) photographs obtained by RB-57 aircraft and very high-altitude (several hundred miles) Earth Resources Technology Satellite (ERTS) imagery. There has also been an accumulation of such documents as flight-logs, ground-truth and research reports which contain raw data and are not available from conventional libraries. It is imperative that all these data be cataloged, indexed, and filed in such a manner that the data can be used.

In an effort to solve this cataloging, indexing, and retrieval problem, various techniques have evolved over the past several years. The system reported herein is basically designed for low-altitude (about 10,000 ft or less) imagery but has the capability of being adapted for any altitude imagery. This Practical System for Cataloging, Indexing, and Retrieval of Remote Sensing Data consists of:

A card catalog,
A site-index-map, and
Site-index-file; Industry-index-file; Project-index-file; and Catalog cards.

Abstract: *The Interdisciplinary Remote Sensing Group at the University of Wisconsin has been laboring long to make remote sensing a workable tool for environmental monitoring especially as related to water quality. For remote sensing to be a useful tool three things are necessary. Firstly, the correct hardware must be available and properly used to obtain the imagery and support data; secondly, this imagery and data must be systematically indexed, filed, and retrieved to be of use; and thirdly, all this remote-sensing imagery and data must be properly analyzed before it is of real use. This paper focuses on the second factor and describes a practical, workable system for cataloging, indexing, filing, and retrieving remote-sensing data. The system is specialized enough to cover scientific remote-sensing needs, but is practical and simple enough to be operated and used by conventional library techniques without undue modification.*

The card catalog is not entirely unlike card catalogs used for library books that the user utilizes to get access to the data he needs. This technique can be adapted by any agency or library utilizing remote-sensing data with a minimum of special effort and knowledge on the part of the librarian.

Background

Organizations handling large volumes of remote-sensing data, such as NASA's Earth Resources Research Data Facility (ERRDF) at the Johnson Spacecraft Center, Houston, Texas, and the Earth Resources Observations System (EROS) Data Center, Sioux Falls, South Dakota, have developed highly sophisticated

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computer retrieval systems. Also centers like the Laboratory for the Application of Remote Sensing (LARS) at Purdue University, West Lafayette, Indiana, and the Environmental Research Institute of Michigan (formerly the Willow Run Laboratories), Ann Arbor, Michigan, have cataloging systems which satisfy their own user demands but are not universal and economical for user demands or adoption by other agencies. For detailed discussion of their systems, (as they existed until 1972) refer to Chapter 5, Singh[1].

The University of Wisconsin Civil Engineering Department had accumulated several thousand 35-mm slides and a large number of 9 × 9-inch prints since 1965 and was facing the problem of misfiling and misplacing them. As a first step in solving this misplacing and misfiling problem, two 35-mm bulk cameras were used which could accommodate up to 30 ft of 35-mm film. These cameras were in effect airborne microfilm cameras and the resulting film was 35-mm microfilm which could be viewed on conventional 35-mm microfilm viewers.

The problem of misplacing a single frame was again solved with the bulk film roll. But it was evident that the traditional library methods were not appropriate for cataloging slides, microfilms, thermal and other forms of imagery because imagery is a pictorial representation of facts which should be described in specific terms. It was, therefore, suggested that a suitable cataloging and indexing system should be built which would be more responsive to the interests and needs of most users of the remote-sensing data.

The System Developed

THE RATIONALE

In libraries books are ordinarily cataloged by author, title and subject, and are accessible accordingly. The usual access points are not available for raw remote-sensing data. (Access point in a file is defined as the term that permits easy access to a specific item in a collection for the purpose of retrieval.)

For retrieving any kind of data which may include imagery, flight-logs, ground-truth and research reports containing raw data, books, publications, periodicals, maps, charts, diagrams, gems or other collections, the cataloging system should be systematic for quick retrieval. The rationale for retrieving remote sensing data should be based on choosing the proper kind of access point(s) that permit quick retrieval and be economically practical. The remote-sensing data could be made accessible under any one, more than one, or under all of the following six access points:

Location,
Subject,
Industry,
Latitude and longitude,
Project or mission, or
Technical data.

A discussion on the suitability of the most appropriate access point follows.

ACCESS BY LOCATION

Location has been considered as one of the best access points for cataloging the remote-sensing data. Location could be divided into four categories as:

Political name,
Geographical name,
Quasi political name, and
Popular name.

Four different ways are chosen to record this information. It is recommended that the sequence and punctuations listed (Fig. 1) should be followed carefully in order to make the system meaningful. Each of the four lines in the location box are assigned for specific information which must be written in its proper place, upper right.

ACCESS BY SUBJECT

Subject categories like Biological, Geological, Oceanographic, etc., are too broad to be meaningful for cataloging remote-sensing data. An image may be seen from different subject viewpoints by different researchers. It was, therefore, decided to avoid cataloging under subject headings which not only would require a scientific evaluation of the imagery by the cataloger, but would limit the usefulness of the imagery to a particular subject.

ACCESS BY INDUSTRY

Industry has been chosen as the next best access point. It must be made clear that this is possible for low-altitude imagery (10,000 ft or less). For medium-altitude (10,000 ft to 40,000 ft) imagery, it may still be possible to identify industries and catalog the imagery accordingly. For high-altitude (over 40,000 ft) and very high-altitude (several hundred miles) imagery, location is the best access point. In such instances location may either be defined by political or geographical name, or by latitude and longitude.

Three attributes have been chosen to describe an industry:

Industry or Product;
Ownership; and
Method.

CALL NO.

AFE-00836
AFR-00836
DDC-00036
DATE: 17 SEP 71

SITE # 004

LOCATION
Political Name, State.: Neenah/Menasha to Kimberly, Wisconsin
Geographical Name (Political Name, State).:
Quasi-Political Name (Political Name, State).:
Political Name, State — Popular Name.:

INDUSTRY
Industry or Product: Ownership: Method
Sewage Treatment Plant: : :
Paper Mill: Kimberly Clark: : :
Industry or Product: Ownership: Method:
Industry or Product: Ownership: Method:

PROJECT
020 NCAR

AERIAL SHOTS ☒ MICROSCOPIC SHOTS ☐ UNDERWATER SHOTS ☐
GROUND SHOTS ☐ LABORATORY SHOTS ☐ OTHER SHOTS ☐

TITLE - STATEMENT
Sewage Treatment Plant near James Island and Kimberly Clark Paper Mill on Fox River: Neenah/Menasha to Kimberly, Wisconsin.

TECHNICAL DATA
FLIGHT ALTITUDE: 1000 ft. TIME: 9A/11A hrs.
CAMERA: 2 Nikons 35 mm. FOCAL LENGTH: 50 mm.
SCANNER: PRT-5 SENSOR: TI-RS-310 GROUND TRUTH: YES ☒ NO ☐
1° LATITUDE: N44-45 1° LONGITUDE: W088-089

FILM	TYPE	FILTER	FOOT/FRAMES	SLIDES	PHOTOS
COLOR	5257	UV	73		
COLOR-IR	2443	15	73		
THERMAL	?				
B & W					
OTHER					

FORMAT
16mm ☐ DIGITAL ☐
35mm ☒ OTHER ☐
70mm ☒
7" x 7" ☐
9" x 9" ☐

REMARKS
FLIGHT NO. 18
D-10782-E, D-10789-R, & D-10700-C

FIG. 1. Sample worksheet for access by location

Examples of a few sample entries are listed in Table 1. Blanks are provided for unavailable or doubtful information.

ACCESS BY LATITUDE AND LONGITUDE

To determine latitude and longitude of each frame or group of frames for low-altitude imagery, would be uneconomical, but for high- and very high-altitude imagery (over 40,000 ft), latitude and longitude of frames, or groups of frames, could be considered as access points. ERTS and RB-57 aircraft imagery could, therefore, be cataloged under latitude and longitude as access points.

TABLE 1. EXAMPLES OF ACCESS BY INDUSTRY

Industry or Product	*Ownership*	*Method*
1 Power Plant	Madison Gas & Electric	Thermal
2 Paper Mill	American Can	
3 Agriculture		Farming
4 Land Form		
5 Water Bodies		
et cetera.		

It was decided that a 1° latitude and 1° longitude (hereafter referred to as 1° square) should be recorded in the Technical Data box as limiting 1° square for the imagery. If the coverage falls in more than one 1° square, each 1° square should be recorded.

The latitude should be recorded after the letter *N* for northern and *S* for southern hemisphere in two-digit numbers, and the longitude should be recorded in three-digit numbers after the letter *E* for east and *W* for west of the Greenwich Meridian. For example: *1° LATITUDE*, N44-45; *1° LONGITUDE*, W088-089.

ACCESS BY PROJECT OR MISSION

Project or mission as an access point would limit the use of the imagery to specific users and as such it has not been considered as an access point.

ACCESS BY TECHNICAL DATA

From analysis of user requests it was found that a request for data was seldom referred to its technical information. After critical evaluation it was decided not to use technical data as an access point.

THE DESIGNED SYSTEM

The system described herein is designed for retrieval of remote-sensing data which include imagery, magnetic tapes, flight logs, maps, ground-truth reports and research reports containing raw data; and it makes provision for inclusion of other pertinent information. The primary features of the system are:

A card catalog
A site-index-map; and
Site-index-file; Industry-index-file; Project-index-file; and Catalog cards.

For systematic cataloging of any collection the cataloger usually completes a form called a *Worksheet* for a new document. This information describes the item and is subsequently used for preparing the catalog card. The worksheet thus becomes an important document in the system and will be discussed later.

FLIGHT LOG

A flight crew invariably maintains a flight log at the time of data acquisition. In some instances (9 × 9-inch or ERTS imagery) the technical information is automatically recorded on each frame. The flight log and the recorded information on the imagery is extremely helpful to the cataloger in completing a worksheet. A suggested flight-log form is shown in Figure 2.

THE WORKSHEET

Out of several designs, the worksheet shown in Figure 1 was considered to be very effective for transferring most of the information from the flight log and imagery to the worksheet and subsequently onto the catalog card.

The Call Number. The format of the call number used in the system is designed to identify the format, the generation, the type and the date of imagery or the related flight-logs, maps, ground-truth, and research reports which contain raw data and are not available from conventional libraries.

The format of the call number has a nine-digit field which is followed by a seven-digit field on the second line for the date of imagery or documentation. The first field of call number is a triple letter code which identifies the specific data type. Figure 3 is an example of a call number.

Image Format. Image format is identified by the first upper-case alpha letter and non-imagery documents by the first nine numerics. The code for the image format is shown in Table 2. The code of Table 2 would cover any imagery or related reports containing raw data for cataloging purposes.

Original or Duplicate. The second alpha digit identifies original or duplicate imagery and its generation, i.e., first, second, third, etc. (Table 3).

Image Type. The third alpha digit identifies the image type. Imagery of various bands, such as bands *1* through *8* in ERTS imagery, will be identified by first nine numerics. (Table 4). Any image format can be accommodated by this code which has many open spaces for future additions. Note that the alpha letters *I* and *O* are omitted to avoid ambiguity and debugging later.

Shelf or Index Number. This five-digit file, shelf, or index number in the second field is used to indicate the sequential acquisition of the data. For each different format, separate sets of sequential numbers are assigned. For

example, AFE-00015 is for the 15th roll of microfilm, and CFE-00015 is the call number for the 15th file of 35-mm slides, etc.

Research requirements may demand cutting of a roll of film. In such instances, decimal numbers in hundredths are used after the shelf or index number in order to identify each different piece of film. For example:

DDG-00046.01
06 APR 72
DDG-00046.02
07 APR 72.

Date of Photography or Documentation. The third field is of seven digits and refers to the date of imagery or documentation. The first two spaces are for the numerical date, the middle three spaces for alpha letters of the month, and the last two spaces for the year.

For imagery taken on more than one date or over two months, slashes are used, such as:

13/16 AUG 71 or *29/01 FEB/MAR 72.*

The field width here increases to 10 or 14 digits.

Site Number and Site-Index-Map. For the

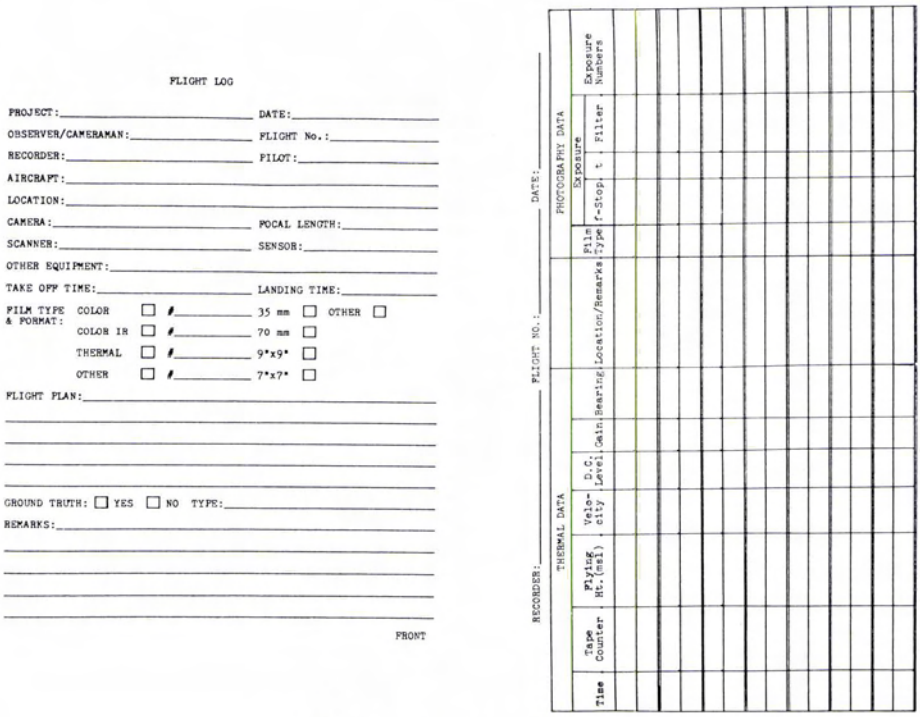

FIG. 2. Suggested flight log form.

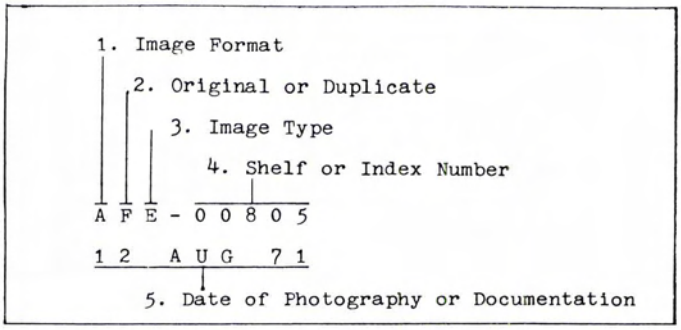

FIG. 3. Example of a call number.

TABLE 2. CODE FOR THE FIRST ALPHA LETTER OR NUMERIC FOR IMAGE FORMAT IN THE FIRST FIELD

Z	Undefined Format	*R*	Microfiche
A	35-mm Microfilm	*S*	(Open)
B	35-mm Step Wedge Film	*T*	Magnetic Tape
C	35-mm Slides	*U*	(Open)
D	70-mm Roll Film (nonphotographic-Thermal etc.)	*V*	(Open)
		W	(Open)
E	70-mm Roll Film (photographic-Hasselblad etc.)	*X*	(Open)
F	70-mm Frames	*Y*	(Open)
G	(Open)	*1*	Site Maps
H	35-mm Calibration Film	*2*	(Open)
J	(Open)	*3*	(Open)
K	16-mm Cassettes	*4*	(Open)
L	16-mm Microfilm	*5*	(Open)
M	9.5-inch Roll Film	*6*	(Open)
N	9 × 9-inch Frames	*7*	Progress Report
P	7.5-inch Roll Film	*8*	Inflight Records
Q	7 × 7-inch Frames	*9*	Miscellaneous/ Undefined

purpose of maintaining a records of the sites flown and recorded in the location box of worksheet (No. 004 as in Figure1), a Site-Index-Map (Figure 4) is prepared on which the sites are marked and are given a three-digit number. The site-index-map thus becomes a useful index to the user, informing him on the availability of data reference in the card catalog. A list and explanation of site numbers is kept in the site-index-file and a card catalog is also maintained. A sample entry from the site-index-file is:

014 Snake Lake (Lincoln County, Wisconsin).

It must be noted that site numbers are assigned to relatively large areas and not to individual frames. A list of site numbers for the fifty states in the USA and a partial list of counties in the state of Wisconsin is given in Appendix A.

THE CARD CATALOG

Type and Format. Most of the information recorded on the worksheet is typed on 3 × 5-inch cards as shown in Figure 5. For the purpose of cross-referencing, added entry cards are typed with their main entry heading obtained by first switching entries in the location box and then by switching places of industry and location boxes. In Figure 6, six such cross-referencing cards are shown, which are typed for the same card shown in Figure 5. In order to trace the number of cards for a particular image, tracer headings are typed at the bottom of each set of cards.

The cards are alphabetized for the main entry heading only and are arranged chronologically for keeping the latest date first.

TABLE 3. CODE FOR THE SECOND ALPHA LETTER IN FIRST FIELD

Z	Unknown Generation	*G*	Duplicate Third Generation
F	First Order or Original Imagery or Documents	*H*	Duplicate Fourth Generation
D	Duplicate First Generation	*J*	Duplicate Fifth Generation
E	Duplicate Second Generation		

For uniformity of the catalog cards, Elite type shown in Sample card in Figure 5 is recommended. It is considered that if the spacings and blanks shown in the sample card are followed, the card catalog file would have a pleasing appearance.

Continuation Card. If all the information cannot be typed on one card, a continuation card is recommended. The words *(CONTD)* and *(CARD 2)* should be typed at the bottom-

TABLE 4. CODE FOR THIRD ALPHA LETTER OR NUMERIC FOR IMAGE TYPE IN FIRST FIELD

Z	Undefined Type	*M*	Digital Tapes
A	Agfachrome Imagery	*N*	Analog Tapes
B	Black & White (Negative)	*P*	Radar
C	Black & White (Diapositive)	*Q*	(Open)
D	Digicolor Imagery	*R*	Color Infrared
E	Ektachrome Imagery	*S*	Black-&-White Infrared
F	Color Prints	*T*	(Open)
G	Black-&-White Prints	*U*	(Open)
H	Anscochrome Imagery	*V*	(Open)
J	Kodachrome Imagery	*W*	(Open)
K	(Open)	*X*	(Open)
L	(Open)	*Y*	(Open)

1	RBV Spectral Band No. 1 (Code 1) .475—.575 microns
2	RBV Spectral Band No. 2 (Code 2) .580—.680 microns
3	RBV Spectral Band No. 3 (Code 3) .690—.830 microns
4	MSS Spectral Band No. 1 (Code 4) .5—.6 microns
5	MSS Spectral Band No. 2 (Code 5) .6—.7 microns
6	MSS Spectral Band No. 3 (Code 6) .7—.8 microns
7	MSS Spectral Band No. 4 (Code 7) .8—1.1 microns
8	MSS Spectral Band No. 5 (Code 8) 10.6—12.6 microns (ERTS B ONLY)
9	Undefined

TABLE 5. SITE NUMBERS FOR THE 50 U. S. STATES

SITE No.	*SITE*	*SITE No.*	*SITE*
501	ALABAMA	526	MONTANA
502	ALASKA	527	NEBRASKA
503	ARIZONA	528	NEVADA
504	ARKANSAS	529	NEW HAMPSHIRE
505	CALIFORNIA	530	NEW JERSEY
506	COLORADO	531	NEW MEXICO
507	CONNECTICUT	532	NEW YORK
508	DELAWARE	533	NORTH CAROLINA
509	FLORIDA	534	NORTH DAKOTA
510	GEORGIA	535	OHIO
511	HAWAII	536	OKLAHOMA
512	IDAHO	537	OREGON
513	ILLINOIS	538	PENNSYLVANIA
514	INDIANA	539	RHODE ISLAND
515	IOWA	540	SOUTH CAROLINA
516	KANSAS	541	SOUTH DAKOTA
517	KENTUCKY	542	TENNESSEE
518	LOUISIANA	543	TEXAS
519	MAINE	544	UTAH
520	MARYLAND	545	VERMONT
521	MASSACHUSETTS	546	VIRGINIA
522	MICHIGAN	547	WASHINGTON
523	MINNESOTA	548	WEST VIRGINIA
524	MISSISSIPPI	549	WISCONSIN
525	MISSOURI	550	WYOMING

right corner of the first card and at the top right corner of the second card, respectively. The complete call number and the main entry heading must be typed on CARD 2. An example is shown in Figure 7.

SITE-INDEX, INDUSTRY-INDEX, AND PROJECT-INDEX FILES AND CARDS

A site-Index-File should be maintained and the entry should be typed on 3 × 5-inch card.

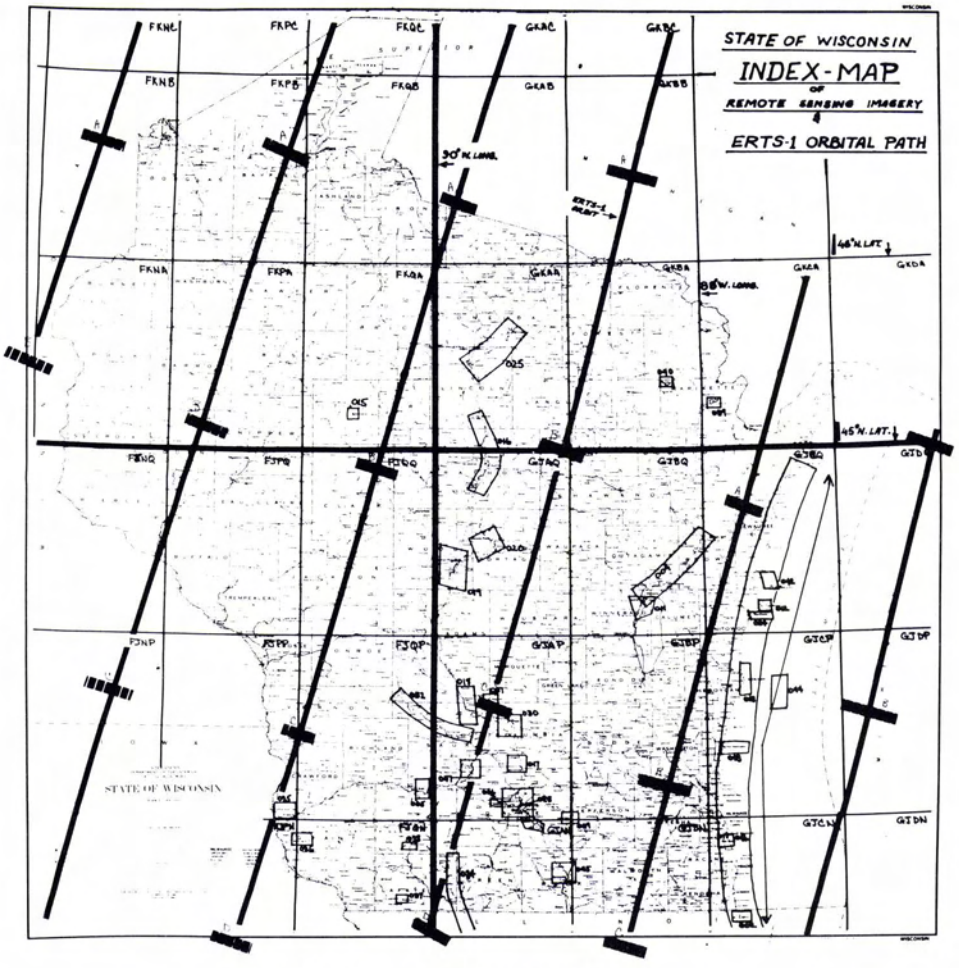

FIG. 4. Example of a site index map.

An Industry-Index-File serves as a guide to the cataloger and should be updated whenever a new industry is to be cited in the worksheet.

To keep track of projects for which data have been cataloged, a Project-Index-File should be maintained. These projects should be assigned three-digit sequential numbers. Imagery not pertaining to any specific project is given project *No. 098 Miscellaneous*, and those obtained for more than two projects are assigned project *No. 099 Multiple* to indicate that the imagery was at the request of, or for the use of, more than two groups of investigators at the time of planning the flight.

The information from these files is typed on 3 × 5-inch cards which are alphabetized and are retained by the cataloger. Reference 4 for these file entries is applied at the University of Wisconsin Remote Sensing Data Center and ERTS Browse File.

CHECK-OUT PROCEDURE

Imagery or document intended for check-out must be signed out on a check-out card. The check-out card used in the Remote Sensing Data Center and ERTS Browse File at the University of Wisconsin is shown in Figure 8.

ERTS IMAGERY

On July 23, 1972, NASA launched the first of a series of experimental Earth Resources Technology Satellites into a sun-synchronous polar orbit around the earth to

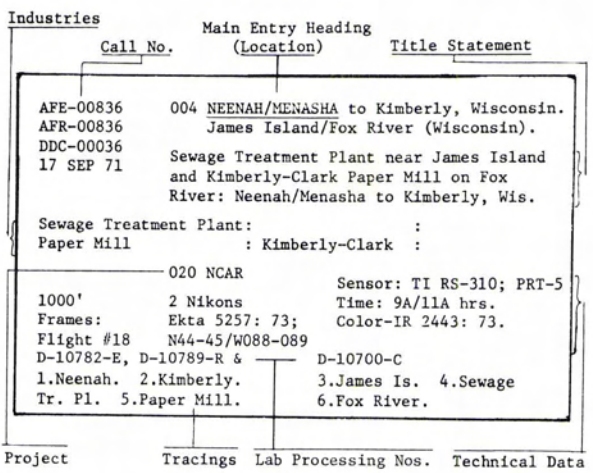

FIG. 5. Type and format data on a 3 × 5-inch card.

AFE-00836
AER-00836
DDC-00036
17 SEP 71
004 NEENAH/MENASHA to Kimberly, Wisconsin.
James Island/Fox River (Wisconsin).
Sewage Treatment Plant near James Island and Kimberly-Clark Paper Mill on Fox River: Neenah/Menasha to Kimberly, Wis.
Sewage Treatment Plant:
Paper Mill : Kimberly-Clark
020 NCAR
1000'
Frames:
Flight #18
2 Nikons
Ekta 5257: 73;
N44-45/W088-089
Sensor: TI RS-310; PRT-5
Time: 9A/11A hrs.
Color-IR 2443: 73.
D-10782-E, D-10789-R & D-10700-C.
1.Neenah. 2.Kimberly. 3.James Is. 4.Sewage
Tr. Pl. 5.Paper Mill. 6.Fox River.

AFE-00836
AFR-00836
DDC-00036
17 SEP 71
004 KIMBERLY to Neenah/Menasha, Wisconsin.
James Island/Fox River (Wisconsin).
Sewage Treatment Plant near James Island and Kimberly-Clark Paper Mill on Fox River: Neenah/Menasha to Kimberly, Wis.
Sewage Treatment Plant:
Paper Mill : Kimberly-Clark
020 NCAR
1000'
Frames:
Flight #18
2 Nikons
Ekta 5257: 73;
N44-45/W088-089
Sensor: TI RS-310; PRT-5
Time: 9A/11A hrs.
Color-IR 2443: 73.
D-10782-E, D-10789-R & D-10700-C.
1.Neenah. 2.Kimberly. 3.James Is. 4.Sewage
Tr. Pl. 5.Paper Mill. 6.Fox River.

AFE-00836
AFR-00836
DDC-00036
17 SEP 71
JAMES ISLAND/Fox River (Wisconsin).
004 Neenah/Menasha to Kimberly, Wisconsin.
Sewage Treatment Plant near James Island and Kimberly-Clark Paper Mill on Fox River: Neenah/Menasha to Kimberly, Wis.
Sewage Treatment Plant:
Paper Mill : Kimberly-Clark
020 NCAR
1000'
Frames:
Flight #18
2 Nikons
Ekta 5257: 73;
N44-45/W088-089
Sensor: TI RS-310; PRT-5
Time: 9A/11A hrs.
Color-IR 2443: 73.
D-10782-E, D-10789-R & D-10700-C
1.Neenah. 2.Kimberly. 3.James Is. 4.Sewage
Tr. Pl. 5.Paper Mill. 6.Fox River.

AFE-00836
AFR-00836
DDC-00036
17 SEP 71
FOX RIVER/James Island (Wisconsin).
004 Neenah/Menasha to Kimberly, Wisconsin.
Sewage Treatment Plant near James Island and Kimberly-Clark Paper Mill on Fox River: Neenah/Menasha to Kimberly, Wis.
Sewage Treatment Plant:
Paper Mill : Kimberly-Clark
020 NCAR
1000'
Frames:
Flight #18
2 Nikons
Ekta 5257: 73;
N44-45/W088-089
Sensor: TI RS-310; PRT-5
Time: 9A/11A hrs.
Color-IR 2443: 73.
D-10782-E, D-10789-R & D-10700-C
1.Neenah. 2.Kimberly. 3.James Is. 4.Sewage
Tr. P. 5. Paper Mill. 6.Fox River.

AFE-00838
AFR-00836
DDC-00036
17 SEP 71
SEWAGE TREATMENT PLANT:
Paper Mill: Kimberly-Clark
Sewage Treatment Plant near James Island and Kimberly-Clark Paper Mill on Fox River: Neenah/Menasha to Kimberly, Wis.
004 Neenah/Menasha to Kimberly, Wisconsin.
James Island/Fox River (Wisconsin).
020 NCAR
1000'
Frames:
Flight #18
2 Nikons
Ekta 5257: 73;
N44-45/W088-089
Sensor: TI RS-310; PRT-5
Time: 9A/11A hrs.
Color-IR 2443: 73.
D-10782-E, D-10789-R & D-10700-C.
1.Neenah. 2.Kimberly. 3.James Is. 4.Sewage
Tr. Pl. 5.Paper Mill 6. Fox River.

AFE-00836
AFR-00836
DDC-00036
17 SEP 71
PAPER MILL: Kimberly-Clark:
Sewage Treatment Plant:
Sewage Treatment Plant near James Island and Kimberly-Clark Paper Mill on Fox River: Neenah/Menash to Kimberly, Wis.
004 Neenah/Menasha to Kimberly, Wisconsin.
James Island/Fox River (Wisconsin).
020 NCAR
1000'
Frames:
Flight #18
2Nikons
Ekta 5257: 73
N44-45/W088-089
Sensor: TI RS-310; PRT-5
Time: 9A/11A hrs.
Color-IR 2443: 73.
D-10782-E, D-10789-R & D-10700-C.
1.Neenah. 2.Kimberly. 3. James Is. 4.Sewage
Tr. Pl. 5.Paper Mill. 6. Fox River.

FIG. 6. Typical cards for cross referencing.

```
  AFE-00868          MUD LAKE (Madison, Wisconsin).
  AFR-00868       028 Madison, Wisconsin.
 *EFE-00063
**MFB-00031       Aquatic Weed Growth and Land Form
***MFR-00031      Studies near Mud Lake: Madison,
   18 JUL 72      Wisconsin.

   Sewage Treatment Plant:          :
   Petroleum:          :
   Land Form:          :
   Water Bodies:          :

                  016 Madison Area Lakes.


                                                  (CONTD)
```

```
                                                  (CARD 2)
  AFE-00868          MUD LAKE (Madison, Wisconsin).
  AFR-00868
 *EFE-00063
**MFB-00031
***MFR-00031
   18 JUL 72
   3500'/3200'    Nikon, Hasselblad &          Time: 13B hrs.
                  Zeiss RMK 15/23.
                                               Super Day.
   Color     5257: 13+92+55 frames.
   Color-IR  2443: 18+56+52 frames.      Stepwedge #BFE-027;
  *Color     5256: 17 frames.                      BFR-027.
 **B & W     2405: 8 frames.  D11603     N43-44/W089-090
***Color-IR  8443: 5 frames.  D11602

   1.Madison.  2.Mud Lake.     3.Sewage Treatment Plant.
   4.Petroleum.  5.Land For     6.Water Bodies.
```

FIG. 7. Example of continuation card.

provide information about natural resources. The first satellite is called ERTS-1 and each scene covering 10,000 square nautical miles is imaged seven times: three images from the Return Beam Vidicon (RBV) and four images from the Multispectral Scanner (MSS). These sensors transmit bits of data through electronic signals in different spectral bands, which are converted into photographic negatives at the Goddard Space Flight Center in Greenbelt, Maryland. The raw data are either system-corrected images (bulk processed) and provided to the EROS Data Center in Sioux Falls, South Dakota in the form of 70-mm film, or scene-corrected images (precision processed) and provided on 240-mm film at a scale of 1:1,000,000.

Cataloging of ERTS Imagery. NASA provides a catalog of ERTS imagery. The ERTS frames also carry latitude and longitude of the principal point. These ERTS frames should be referred in the card catalog by the states and should be filed in the file cabinets according to latitude and longitude.

COMPUTER APPLICABILITY

The manual card catalog and site-index-map system outlined above has the capability of providing all the information needed for switching to a computer retrieval system. Sooner or later, this may have to be done. Keeping in mind the NASA and EROS Data Center Codes for computer printouts (Singh[1], pp. 37-38), it is proposed that the code for seven sort fields as shown below may be adapted as follows:

Field 1. 2 spaces for *Originating Agency.* An arbitrary number 05 has been assigned to the University of Wisconsin Remote Sensing Data Center & ERTS Browse File.

Field 2. 5 spaces for *1° Latitude.*

Field 3. 7 spaces for *1° Longitude.*

Field 4. 7 spaces for *Day, Month, Year of observation.*

Field 5. 11 spaces for *Call Number* out of which last 3 spaces for *Decimal in Call Number.*

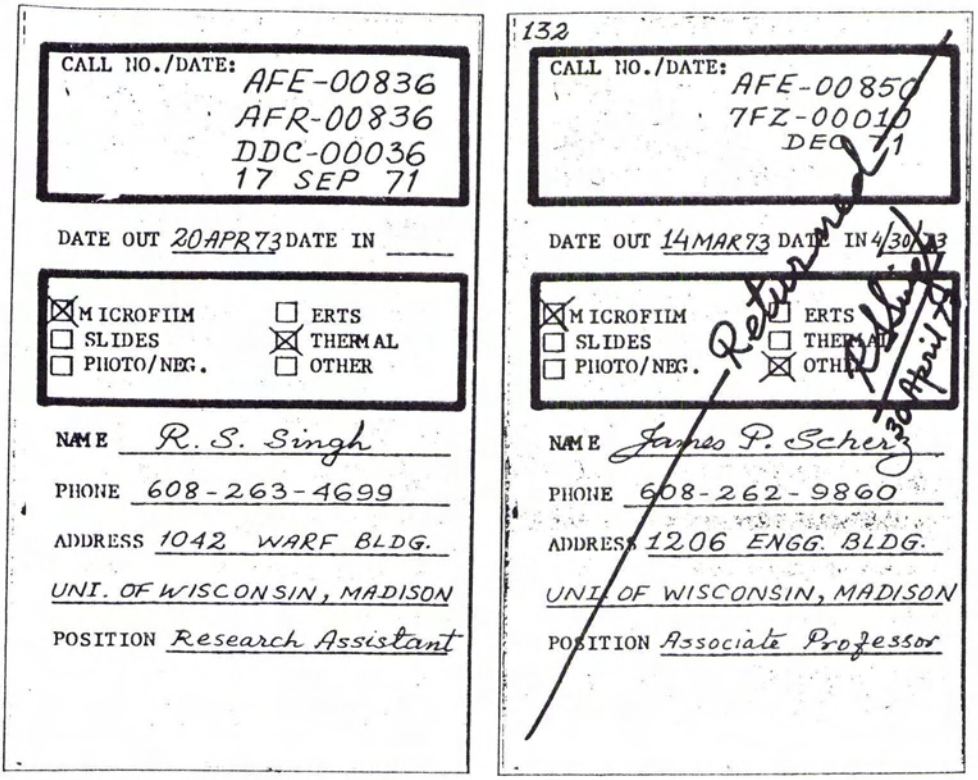

FIG. 8. Examples of check-out cards.

Field 6. 3 spaces for *Site Number.*
Field 7. 3 spaces for *Project Number.*

CONCLUSIONS

The manual card catalog system reported herein has proved that it will fulfill the need for an effective cataloging and indexing system for remote-sensing data. It can be operated by conventional library methods without the utilization of costly computers. Provision has been made, however, for digitizing the system for computer retrieval by providing suitable spacings for call number, location and project codes. Details for switching to automation have not been worked out for two reasons: (1) automated systems already exist at institutions, such as NASA and EROS Data Center, which are handling huge amounts of data on an international level, and which have government budget support; and (2) most institutions utilizing remote-sensing data have limited resources, and are only beginning to handle a substantial amount of data. More so, even to have an automated system, the basic requirement is to have the pertinent information in a systematic form, and the card catalog is the answer to this important requirement.

Users of the data facility at the University of Wisconsin, Madison have commended the system as *excellent.* The system has been tested and found that users can retrieve data within a few minutes.

TABLE 6. AN EXAMPLE FOR NUMBERING COUNTIES IN WISCONSIN

SITE No.	*SITE*
549.01	ADAMS County, Wisconsin.
549.02	ASHLAND County, Wisconsin.
549.03	BARRON County, Wisconsin.
—	—
—	—
549.13	DANE County, Wisconsin.
—	—
—	—
549.21	MENOMONIE County, Wisconsin.
et cetera	

The system has been acclaimed as a practical solution to the present-day problem of remote-sensing data cataloging and retrieval by the participants at the Second Conference on Earth Resources Observation and Information Analysis System, hosted by the University of Tennessee Space Institute in Tullahoma, Tennessee in March 1973, and by the participants at the Management and Utilization of Remote Sensing Data Symposium, sponsored by the ASP, AGI, AIAA and IEEE at Sioux Falls, South Dakota in October-November 1973.

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Appendix A

Table 5 is a list of states and site numbers for the 50 states in the USA. These site numbers are recommended for small-scale imagery as obtained by high-altitude RB-57 aircraft and spacecraft such as ERTS.

Decimal numbers in hundreds are used after the state site number for listing counties alphabetically. An example for numbering counties in the State of Wisconsin is shown in Table 6.