Storage and Naming Standards for Un-Rectified Image Products at the Minnesota DNR

Specifications for
Product Storage, Naming and Organizing Principles

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Minnesota DNR
Air Photo Storage Specifications

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1. Introduction

DNR staff have used aerial photographs as an source of land resource information for many years. As computer technology has permeated the natural sciences through various software products and tools the use of digital air photos become an accepted, if not essential part of doing business for many employees at the DNR. To manage these photos for easy access and distribution it has become necessary to develop a standardized way of naming and organizing the variety of digital air photo products that the department owns or otherwise acquires.

This document proposes a naming and storage structure for "Unreferenced/unrectified" digital products, including aerial photographs and existing hardcopy maps, to facilitate predictable and reliable access to these images by users through a variety of methods including desktop GIS programs, web-browsers and other image viewing tools. This document also addresses the need for an image index - a spatial reference that identifies the approximate photo centers for a project as a point object in a spatial database such as a shapefile.

This document focuses on imagery that will be part of the DNR GIS Data Resource Site (DRS). A DRS is an organized collection of data, metadata and supporting software. It is envisioned that these standards will become part of the DNR's Data Resource Site Specifications[1].

This document is split into three parts:
1) Introduction
2) Background
3) File Naming Conventions
4) Storage Structure Guidelines
5) Spatial Data Format for Index Files

2. Background

Generally speaking, air photo acquisition is conducted for/by an organization (private or public), during a given time frame for a particular area. Project areas are assigned an identification code (generally by the photo contractor) and if these projects are conducted on a regular interval, the project name generally remains constant. While this is not true in all cases, this specification is not designed on this assumption.

For example, air photos for Pope County, MN were acquired for the USDA-ASCS in 1938/39, 1951, 1958 and 1965. The project code assigned for each of these projects is BJJ.

For many products, within each project area the film negative roll and frame number uniquely identify each photograph. In many cases this information can find the date of the image as well as the date the image was acquired.

The following file name and organizational concepts were developed to conform to the DNR's DRS standards. In addition, existing air photo collections were examined to determine how they were organized and stored as a way to gain insights to strengths and weaknesses of various techniques.

3. File Naming Conventions

Because the type of images this document addresses are not georeferenced they cannot be stored using a geographic tiling scheme as defined in the DNR's GIS storage standard, another method must be used. The files need to be organized and named such that each can be uniquely identified. It should be noted that in this document the file naming conventions are all indicated in UNIX file conventions – forward slashes (/) for folder delimiters and all lower-case names.

Aerial Photography
Traditional Air photo acquisition is generally conducted as a "project" for a particular organization. Each air photo project is assigned a name or project code. When the project is flown, each individual photo is assigned a number based on the roll or flight line and frame number for this particular photo. Combining the project name, the roll number and the frame number provides a unique identification value for each photo. This information is also printed on the photo, usually separated by dashes "-". An example of a photo name would be VE-1-1. This image represents the first frame of the first roll for project "ve".

This combination provides a good means of file naming standards for digital imagery although it may be insufficient for some scanned products. In these cases an alternative method will need to be defined. In order to be flexible, filename length is restricted to 64 characters with no spaces or special characters.

File names would consist of the project code followed by two spaces reserved for roll number/flight line and three spaces reserved for frame number. This assumes that there are no more than 99 rolls in a project and 999 frames in a roll.

Based on the earlier example of VE-1-1, the filename for a JPEG formatted image would be ve01001.jpg.

This works well until you have areas where multiple years of imagery have been scanned. While the date of the image could be a part of the image filename the overhead of adding this level of detail to the filename is significant. In addition the availability of the dates on the images themselves provides a permanent record of when the image was acquired. Differentiating different years of photos will be accomplished by storing the images in different folders.

Other Products
For products that do not fit these naming conventions other alternatives must be explored. The minimum naming standards that must be met are that the files have unique names. As new products are developed, project and filenames will have to be developed for those products.

4. Storage Structure Guidelines

Since DRS structure is a file-based system for managing data, storage conventions are also an important component of this specification. These storage definitions are hierarchical and have a folder based structure designed to be robust enough to satisfy a variety of situations The file storage hierarchy proposed here is based on a scheme of folders with names based on a provider code, a project code and a project year.

The DRS specification defines the folder "drs/ancillary" as the location to store non-referenced spatial data. It is proposed that the parent folder to store digital imagery is called "imagery" (/drs/ancillary/imagery).

This is a flexible system however and is not restricted to the proposed DRS parent folder. For organizations that don't use DRS storage standards as a way of organizing their GIS data the source folder for imagery can and will vary. This system is designed to be generic above the source provider folder.

PROVIDER Identifier
Imagery is often referenced by the organization that provides or purchases the imagery. Some examples include "DNR Resource Assessment", "NAPP" and "FSA". Typically, each of these programs has a consistent set of acquisition parameters including plane height, dates, and content. This provides the next level of organization in the structure. The photos for a particular Program/Provider will be stored in a folder with a name based on that provider, 13 characters (?) or less. A review of imagery archives at the John R. Borchert Map Library at the University of Minnesota lists nine sources of imagery for the state. These sources include the Agricultural Stabilization and Conservation Service, US Forest Service, National Aerial Photography Program, Minnesota Department of Natural Resources, Division of Forestry, Metropolitan Council, Markhurd Aerial Surveys, Inc., Horizons Inc., Clyde E., Williams & Associates (CEWA).

There are also several potential program/providers that can be identified. While these program/provider codes can be developed at the time they are encountered it is desirable to define as many of these as possible.

Based on information from the Borchert Map library and taking advantage of abbreviations already in use at the DNR, the following abbreviations are proposed.

Code	Provider
ASCS	Agricultural Stabilization and Conservation Service
BWSR	Board of Water and Soil Resources
NAPP	National Aerial Photography Program

FORCIR	Minnesota Department of Natural Resources- Division of Forestry Color Infrared photographs
ECO	DNR Division of Eco Services
ENF	DNR Division of Enforcement
FOS	DNR Field Operation Services Bureau
FSH	DNR Division of Fisheries
LAM	DNR Division of Lands and Minerals
PRK	DNR Division of Parks
TAW	DNR Division of Trails and Waterways
WAT	DNR Division of Waters
WLD	DNR Division of Wildlife
MNDOT	Minnesota Department of Transportation
HOR	Horizons Inc.
MC	Metropolitan Council
SCS	Soil Conservation Service
USFWS	US Fish and Wildlife Service
USFS	US Forest Service
USGS	United States Geologic Survey
ACM	Coastal Zone Management Program
COE	United States Corps of Engineers
MH	Markhurd

It is likely that this list will grow over time as new project/providers emerge.

As an example, the folder for color infrared photos acquired by the Minnesota DNR would be named

/drs/ancillary/imagery/forcir

PROJECT Identifier
The project portion of the file storage convention provides the first spatial context for the imagery. Projects occur over a fixed piece of geography, many times based on county boundaries, but not always. Therefore, folder name should be the same as the project name. For example, DNR Forestry Resource Assessment photos for Itasca County are assigned a project code of "ita" and a folder name of "ita".

/drs/ancillary/imagery/forcir/ita

Project identifiers should be selected with care and some sort of oversight is required to ensure unique names. Currently, there are a number of project identifiers already in use and these are listed below.

County	ASCS Project ID	USFS Project ID	DNR Forestry Project ID
Aitkin	BXN		AIT

Anoka	BIM		MET
Becker	BXO		CBM, BBC
Beltrami	CIN		BEL, BBC
Benton	BIN		
Big Stone	BIO		
Blue Earth	BIP		
Brown	BIQ		
Carlton	BXP		CAR
Carver	WM		
Cass	BXQ		CCW
Chippewa	BIR		
Chisago	BIS		CIK, CHI
Clay	BXR		
Clearwater	BXS		CBM, BBC
Cook	CIT	FX	COO
Cottonwood	BIT		
Crow Wing	BXT		CCW
Dakota	WK		MET
Dodge	WC		
Douglas	BIU		POD
Faribault	BIV		
Fillmore	VZ		WFH, FIL
Freeborn	VX		
Goodhue	WH		GOW, GOO
Grant	BIW		
Hennepin	WN		MET
Houston	WA		WFH, HOU
Hubbard	BXU		HUB
Isanti	BIX		CIK, ISA
Itasca	CIP		ITA
Jackson	BIY		
Kanabec	BXV		CIK, KAN
Kandiyohi	BIZ		
Kittson	BXW		
Koochiching	CIO		KOO
Lac Qui Parle	BJA		
Lake	CIS	FX	LAK
Lake of the Woods	CIQ		LWR
Le Sueur	WF		LSN
Lincoln	BJB		
Lyon	BJC		
McLeod	WL		
Mahnomen	BXX		CBM, BBC
Marshall	BXY		

Martin	BJD		
Meeker	BJE		
Mille Lacs	BXZ		CIK, MIL
Morrison	BYA		MOR
Mower	UY		
Murray	BJF		
Nicollet	BJG		LSN
Nobles	BJH		
Norman	BYB		
Olmsted	WB		GOW, OLM
Otter Tail	DA		POD
Pennington	BYC		
Pine	BYD		PIN
Pipestone	BJI		
Polk	BYE		
Pope	BJJ		POD
Ramsey	WO		MET
Red Lake	BYF		
Redwood	BSE		
Renville	BJK		
Rice	WG		RIC
Rock	DG		
Roseau	BYG		LWR
St. Louis	CIR	FX	SLN, SLS
Scott	WJ		MET
Sherburne	BJL		SHE
Sibley	BJM		
Stearns	BJN		
Steele	WD		
Stevens	WJO		STE
Swift	BJP		
Todd	BYH		TOD
Traverse	BJQ		
Wabasha	WI		GOW, WAB
Wadena	BYI		WAD
Waseca	WE		WAS
Washington	CCZ		MET
Watonwan	BJR		
Wilkin	BYJ		
Winona	CS		WFH, WIN
Wright	WP		
Yellow Medicine	BJS		

Year Identifier

The "Year" portion of the file storage convention is required because projects are often done on a repetitive basis over the years. The year designation helps to organize the imagery for large geographic areas that may contain many thousands of individual images. The year folder is named with a "Y" and the four-digit year. For example, DNR Forestry Resource Assessment photos for Itasca County in 2003 are stored in a folder called Y2003.

> /drs/ancillary/imagery/forcir/ita/y2003

5. Spatial Data Format for Index Files

Because these images are not georeferenced they must be spatially referenced in another way. This is done via an image index spatial data file. This spatial file contains point features that represent the approximate centers of the frames (photos) for a particular project year. This file provides the basis for which users can access individual photos via ArcView, LandView, web applications or other custom-built products.

These index files should be stored within the project year folder. The indexes should be named INDX_imgpt<scale_identifier>. The scale identifier code should correspond with established DNR scale identifier codes.

> /drs/ancillary/imagery/forcir/itas/y2003/indx_imgpt3
>
> FILENAME = path and image name for image file starting with the provider code
> PROV = name of provider
> PROJ = Project code
> YEAR = Year of imagery acquisition
> PHOTO_ID = Name of image (VE01001)
> EXT = Image extension (jpg, tif, etc)
> COUN = two digit county code of centroid
> CTY_ABBR = county abbreviation of county centroid falls in
> XUTM = UTM NAD83 X coordinate of photo frame centroid
> YUTM = UTM NAD83 Y coordinate of photo frame centroid
> STATUS =   0 if image has not been scanned,
>   1 if image has been scanned,
>   2 if image has been rectified,
>   3 if image has been orthorectified

Individual project indexes can then be merged together in various forms to produce composites of these image points. A wide variety of product generation routines could be developed to provide a wide variety of image center mosaics.