Aerial Photography Field Office (AFPO)

Historical Imagery Holdings For The United States Department of Agriculture (USDA)

Written by Louise E. Mathews
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Summation

The format of this report was to answer some basic questions about the Aerial Photography Field Office's historical film library (affectionately known as "the vault"), its past, and its future. The questions I pose here are why we have this collection, what is in it, what can it be used for, who uses it, and why should it be archived digitally. Scanning the vault would be a mammoth undertaking, and some clear decisions would need to be considered before it is seriously proposed.

The Aerial Photography Field Office (APFO) reputedly has one of the largest collections of historical aerial photography in the nation. It was acquired as an aid to county offices in administering farm programs. In addition to serving the Farm Service Agency (FSA) and its predecessors, APFO has contracted imagery acquisition for the Forest Service (FS), National Resources and Conservation Service (NRCS), and others.

There are 54,533 rolls in the APFO film library. The largest part of the collection, 43%, is ASCS film dating from the mid-1950s through 1982. Nearly all of this is Black and White. Over 20% of the imagery is Natural Color, flown for the Forest Service. The rest was flown for a number of other programs, including the National High Altitude Program (NHAP) and National Aerial Photography Program (NAPP).

Overall, over 63% of the film is Black and White; 22% is natural color, and the rest is Color Infrared (15%). 87.2% is negative film and 12.8% is positive film. Nearly 60% of the film was flown before 1980, and nearly all of the film is in the "normal" 9" x 9" flying format.

There are 83,875 indexes in the vault. This number refers to individual index sheets; in many cases, more than one sheet was needed to cover a county area. Over 78% of these are photo indexes, and date from the earlier years of the collection. The last photo indexes were made in 1984. Some of these are in fragile condition; the catalog lists over 100 of poor quality, and these might not holdup to even an archival scan. There is no georeferencing information with these indexes, or with the accompanying rolls of film. This would need to be addressed in order to create an online ordering system, or even a more geographically friendly system for the Sales Section to use. Center point data is available for newer imagery, and this could be easily used in GIS to create custom indexes, perhaps using Digital Raster Graphics (DRGs) or an automated imagery search.

The quality of film in the film library is considered to be good by those who have daily contact with it.

Historical aerial photography has a great many potential uses, and more would be uncovered as it becomes increasingly available. In addition to the original agricultural uses, aerial photography can provide a historical record for studying such things as land use change, landform change, demographic change, and habitat assessment. It can be used for community planning, environmental enforcement, industrial projects, transportation planning, creating base maps, and basic enjoyment.

APFO is currently doing custom scanning, and has a four month backlog of orders. These scans are not archived, as there is no standard format, size, or metadata creation.

Continuing this activity without changes, or in line with set standards and metadata creation, would be one necessary option for the future of the library. Custom scans for “high end” customers (who may want greater detail than in a standard format) will always be a part of APFO’s workload.

Orders for imagery submitted from January 2002 through December 2004 came largely from the general public. Nearly 66% of all work orders were from the public, but these accounted for less than 10% of the actual units requested. Most of the units requested were for APFO Contracting Obligations or the Forest Service. This would be expected, since this was the basic work commitment of this office. Looking at work order requests from the last two years for imagery flown between 1954 and 1992, the public was the largest customer in both areas, accounting for over 70% of work orders and over 39% of units. Requests for NDOP and NAIP imagery came almost entirely from federal users, with the largest being (as expected) APFO internal orders and the Farm Service Agency. Interest in digital imagery from the states and general public might need to be developed.

Many opinions and options exist regarding the need to archive the library and how to go about it. These will need to be thoroughly studied before moving forward.

Summary of Film Library Holdings

(Readers Digest Version)

Indices:

Photo Indexes	65672
Spot Indices	5027
Line Indices	10998
“Digital” Indices	2178
Total:	83875

Rolls:

Total: 54533 rolls (excluding film related to the national programs)

By Band:

BW:	34542	63.34%
CIR:	7963	14.60%
Color:	12024	22.05%
Unclassified	4	0.007%

By Program:

ASCS	23447	43.00%
BIA	199	0.36%
BLM	247	0.45%
FS	19675	36.08%
FSA	31	0.06%
GS	8	0.01%
MIL	28	0.05%
MILA1	16	0.03%
MILA2	51	0.09%
NA	21	0.04%
NAPP1	1937	3.55%
NAPP2	1846	3.39%
NAPP3	1832	3.36%
NASA	513	0.94%
NFAP	587	1.08%
NHAP1	1458	2.67%
NHAP2	239	0.44%
NPS	55	0.10%
NRCS	211	0.39%
OTHER	56	0.10%
PSU	15	0.03%
SCS	2061	3.78%
	54533	100%

By Type:

Negative:	47531	87.2%
Positive:	6978	12.8%
Internegative:	19	<1%
Half Tone:	4	<1%

By Year:

1947 -1952	<1%	Mostly ASCS
1953-1971	48.8%	ASCS, FS
1972-1979	15.8%	FS, ASCS
1980-1986	11.5%	FS, NHAP
1987-1992	9.7%	FS, NAPP1
1993-1996	6.3%	NAPP2, FS
1997-2004	7.9%	FS, NAPP3

ACRONYM GLOSSARY

ASCS	Agricultural Stabilization and Conservation Service
APFO	Aerial Photography Field Office
BIA	Bureau of Indian Affairs
BIRN	Black and White Infrared Negative
BIRP	Black and White Infrared Positive
BLM	Bureau of Land Management
BN	Black and White Negative
BNDN	Black and White Duplicated Negative
BNRD	Black and White Rectified Negative
BP	Black and White Rectified Positive
BWHT	Black and White Halftone
BWIN	Black and White Internegative
CIND	Color Infrared Negative Duplicated
CIPD	Color Infrared Positive Duplicated
CIRN	Color Infrared Negative
CCM	Compressed County Mosaic
CD	Compact Disc
CIR	Color Infrared
CLU	Common Land Unit
CN	Color Negative
CP	Color Positive
DI	Digital Index
DLT	Digital Linear Tape
DOI	Department of the Interior
DOQQ	Digital Ortho Quarter Quad
DRG	Digital raster Graphics
DVD	The original acronym came from "digital video disc." Some Members of the DVD Forum tried to express that DVD goes far beyond video by retrofitting the painfully contorted phrase "digital versatile disc," but this has never been officially accepted by the DVD Forum as a whole. The DVD Forum decreed in 1999 that DVD, as an international standard, is simply three letters.
ECW	ERMapper Compress Wavelets. "The ECW compressed image format is the popular standard for compressing and using very large images."
EDC	EROS Data Center
EROS	Earth Resources Observation Systems
ESRI	Environmental Systems Research Institute
FS	Forest Service
FSA	Farm Service Agency
GDW	Geospatial Data Warehouse
GeoTIFF	A newly emerging interchange standard, which permits the addition of Geographic information such as projections, datums, etc, associated with remote sensing or cartographic raster data.
GIS	Geographic Information System (or "Science") (due to the expansion of GIS and its capabilities, some academics would like to see the "S" refer to "Science".)
GPS	Global Positioning System

GS	(U.S.) Geographic Survey
ILHAP	Illinois Historical Aerial Photograhy [program]
IMG	
ISGS	Illinois State Geologic Survey
JP3	JPEG 2000 compression format.
LI	Line Index
MDOQ	Mosaicked Digital Ortho Quad
MIL	Military
MrSID	Multiresolution Seamless Image Database. “A powerful wavelet-based image encoder, optimizer, viewer and file format designed specifically for GIS professionals for true portability of massive images.”
NA	Not Applicable
NAIP	National Agricultural Imagery Program
NASA	National Aeronautics and Space Administration
NASS:	National Agricultural Statistics Service
NAPP	National Aerial Photography Program
NDOP	National Digital Ortho Program
NFAP	National Forest Application Program
NHAP	National High Altitude Progam
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources and Conservation Service
PI	Photo Index
PSU	Primary Sample Unit; a plot of ground studied under the National Research Inventory.
SCS	Soil Conservation Service
	S&T Scientific and Technical
SI	Spot Index
TIFF	Tagged Image File Format; a format for raster data interchange. Copyright held by Adobe Systems, Inc.
USDA	United States Department of Agriculture
USGS	United States Geological Survery

Chapter 1: Photo Programs Through the Years

Why do we have such an extensive collection of imagery at the Aerial Photography Field Ofiice?

The use of aerial photography in agricultural programs dates from 1935. After the twin devastations of the Depression and the Dust Bowl, programs were set up to assist farmers. These included the Federal Crop Insurance Corporation or the Soil Bank Program of 1956, which became the Conservation Reserve Program. Over the years, agricultural services have expanded, and aerial photography has been used to assist county offices in administering the programs.

FSA's website describes its current role as follows:

> The Farm Service Agency (FSA) supports American farmers through commodity programs, farmer operating and emergency loans, conservation, domestic and overseas food assistance and disaster programs that improve the economic stability of agriculture and the environment. These programs help farmers produce an adequate food supply, assist farmers to compete for export sales of commodities in the world marketplace, and keep consumer prices reasonable while caring for the environment and natural resources.

The aerial photography products, analog and digital, which have passed through APFO have played a crucial role in supporting the agency's mission.

APFO's role in administering farm programs was the creation of rectified photo enlargements. Rectification is a process which eliminates variation in photo scale and image displacement from tip and tilt (Lillesand and Kiefer, 336). Several scales and photo sizes were used over the years. For most program years, county offices were supplied 24" x 24" photos at a scale of 1: 7920 (1" = 660'). County officers drew field boundaries directly onto these photo enlargements, along with identifying tract and field numbers, and basic information such as crops or erodibility status. These boundaries, known as Common Land Units (CLUs), remain the basic unit in farm program administration.

Over 40% of the holdings at APFO were acquired through the Agricultural Stabilization and Conservation Service (ASCS), and date from 1947 – 1990. Nearly 65% of the imagery in APFO's collection dates from 1947 -1979, when ASCS was in operation. ASCS film is listed as "FSA" in the online catalog.

Another large part of the collection, totaling 36%, is made up of Forest Service (FS) imagery. APFO initially began contracting Forest Service flying because some regions did not have the capability to acquire imagery. In 1976, agency heads decided that it was seen as more cost effective to have one central aerial photography office than to have regional offices operating independently. Before 1976, there were two ASCS labs: the one in Salt Lake City, UT and another identical office in Asheville NC. The Asheville office was closed, and some of the employees transferred to Salt Lake. All USDA projects larger than 100 square miles were required to be contracted through APFO.

APFO acquired about 1% of its collection for the National Forestry Application Program (NFAP), a USFS initiative. This was primarily high altitude color photography. Some of this 1:40,000 film has been orthorectified by the Forest Service Office in Salt Lake City.

In 1980, further consolidation efforts produced NHAP, the National High Altitude Program. For three years, under NHAP, the scale used was 1" = 1000' for enlargements. The objective of this USGS coordinated interagency program was to eliminate duplication in government imagery acquisition. In 1987, the name was changed to the National Aerial Photography Program (NAPP). Beginning in 1985, duplicate copies of film were kept both at APFO and at the Earth Resources Observation Systems (EROS) Data Center (EDC) in Sioux Falls, S.D. About 13% of APFO's vault is made up of NHAP and NAPP photography.

NAPP was established to coordinate the collection of aerial photography covering the 48 contiguous States and Hawaii every five years. NAPP's goals are to ensure that photography with uniform scale, quality, and cloud-free coverage be made available to meet the requirements of several Federal and State agencies. The flying height for the program changed from 40,000 feet to 20,000 feet. NAPP photography is available in black and white, or color-infrared. The program is administered by the U.S. Geological Survey's National Mapping Division. NAPP imagery is used by the USGS for photo revision and land use/ land cover characterization work on the standard series maps at 1:24,000; 1:100,000 and 1:250,000 scales (Source: EDC Glossary)

The following Federal agencies have contributed funds to NHAP and NAPP: U.S. Department of Agriculture (USDA) Farm Services Agency (FSA), formerly known as the Agricultural Stabilization and Conservation Service (ASCS), U.S. Forest Service (USFS), National Agricultural Statistics Service (NASS), National Resources Conservation Service (NRCS), previously known as Soil Conservation Service (SCS), and from the U.S. Department of Interior (DOI): Bureau of Land Management (BLM), U.S. Geological Survey (USGS). The Tennessee Valley Authority also contributed to this project.

The FSA was set up during the USDA's 1994 reorganization, which incorporated programs from several agencies. These included the ASCS, the Federal Crop Insurance Corporation (now a separate Risk Management Agency), and the Farmers Home Administration.

FSA began moving towards a digital environment for farm programs in the mid 1990s. The agency recently completed an enterprise purchase of computers with Geographic Information System (GIS) software from Environmental Systems Research Institute (ESRI).The county offices were to replace the paper enlargements with digital imagery, and the hand drawn field boundaries were replaced by GIS shape files for the CLUs. Some states set up digitizing centers to transfer the CLUs from paper imagery to the screen, using Mosaicked DOQs as a base layer (MDOQs). Other CLU digitizing was contracted out.

A detailed explanation of the GIS program can be found in the USDA Online Fact Sheet, located at:
http://www.fsa.usda.gov/pas/publications/facts/html/gis03.htm

MDOQs were an APFO product. USGS DOQQs (digital ortho quarter quads) were seamed together and tonally matched to produce "seamless" images covering the same area as a 7.5 ' USGS topographic map. These were used to create compressed county mosaics

covering an entire county. The DOQQs were created from NAPP imagery, so APFO's collection includes digital and film versions of the same scenes from the same flying years.

FSA programs require that compliance be done every year after the growing season. One method checking compliance was the use of 35mm slides, often contracted locally, or at a state level. The slides were then projected onto the paper enlargements, and the farmers' compliance with program terms analyzed. With the coming of GIS, the 35mm slide program needed to be replaced by digital images. The MDOQ base layer, which was often 5 - 10 years old, also needed to be updated.

The solution to these problems was the establishment of the National Agricultural Imagery program (NAIP). This is Natural Color and Color Infrared imagery, to be flown at 2 meter resolution for compliance purposes, and one meter resolution for base layer imagery. The imagery is acquired with both digital and film cameras. Film from NAIP imagery is also being archived at APFO.

Sources:

Lillesand,Thomas and Ralph Kiefer. *Remote Sensing and Image Interpretation* J Wiley and Son, New York, 1994

SQL Queries: Kathleen Casterline

Verbal Communication: David Davis, Bruce Finch, Geoffrey Gabbott, Jimmie Kniss, Bonnie Mullen, Peter Parrish

Chapter 2: What does our Film Library Contain?

The collection of aerial photography housed in the historical film library at the Aerial Photography Field Office (APFO) is reputed to be one of the largest in the country. Its initial purpose was to maintain a photographic record of the nation's farmlands for use in administering farm programs.

National Aerial Imagery Program (NAIP) film has been removed from this listing, since it was delivered primarily as a digital product, and would not need to be scanned. However, NAIP projects flown with film cameras do have the rolls archived at APFO. Technically, it is "historical" imagery (or will be in a year or so!)

Film Holdings

By Program:

Excluding more recent film from the new NAIP program, the library contains 54,533 rolls of film and 83,875 indexes (Some areas required more than one index sheet to cover the area). A roll of film would generally have an average of 160 – 170 exposures per roll. A maximum would be 280 exposures). The largest part of the collection, about 43%, came from the Agricultural Stabilization and Conservation Service (ASCS), the precursor of Farm Service Agency (FSA). The second largest program represented was the Forest Service and the Forest Service's National Forest Application Program, with over 37% of the rolls. Over 13% of the film was flown through the national programs, National High Altitude Photography (NHAP) and National Aerial Photography Program (NAPP). The rest of the collection is made up of film flown for other agencies, including nearly 4% for SCS, which is now the National Resources and Conservation Service (NRCS).

For more detail, see Appendix 1, Rolls by Program.

By Film Type:

Over 63% of the film is Black and White; 22% is Natural Color, and the rest (15%) is Color Infrared. 87.2% is photo negative and 12.8% is positive. The film choice was usually determined by the agency requesting the imagery. The national film programs have different requirements from the Resource Photography Projects ; this would refer to photography for other agencies such as Forest Service or BLM, which is contracted through APFO.

Largest Single Categories by Type and Program

Type:	Program	# of Roll	% of Type	% of Total Rolls
	BN:ASCS	23411	69.50	42.93
	CN: FS	11340	94.69	20.79
	CIRP:NAPP	229	53.82	6.75
	BN:NAPP	1876	5.57	3.44
	BN: SCS	1854	5.50	3.40

A detailed breakdown by film type can be found in Appendix 2, Rolls by Type.

By Year:

A rough breakdown of film holdings arranged chronologically is as follows:

1947 – 1954	<1%	Mostly ASCS
1955 – 1971	48.8%	ASCS, FS
1972 – 1979	15.8%	FS, ASCS
1980 – 1986	11.5%	FS, NHAP
1987 – 1992	9.7%	FS, NAPP1
1993 – 1996	6.3%	NAPP2, FS
1997 – 2004	7.9%	FS, NAPP3

For more detail, see Appendix 3, Vault Holdings by Year

Film Format:

A query of film format lists 54738 rolls in Normal 9” x 9” flying format. There were 102 rolls in a special 9” x 18” format. 552 rolls were side edited.

Duplicated Film:

In 1980, the national film program (NHAP) began making a Black and White internegative copy of the film. This was necessary because the enlargers could not use the CIR film, and enlargements were needed in the county offices.

In 1985, USDA began the system of making duplicate rolls of film, with a copy stored both here at APFO and at the Earth Resources Observation Systems (EROS) Data Center (EDC) in Sioux Falls, SD. Film for the eastern part of the U.S. is stored here, and film for the western part is stored in South Dakota. In the vault where the film library is stored, original film is marked with a green dot, and duplicated film with a red dot. The number of duplicated rolls at APFO is:

ASCS	2	NASA	58
BLM	1	NHAP1	1446
FS	13	NHAP2	209
NRCS	75	NAPP1	2999
SCS	75	NAPP2	3350
		NAPP3	2271

Earlier years of photography in the National High Altitude Photography (NHAP), have both original and duplicated rolls stored in APFO’s film library. Both rolls have the same number, but there are different spot numbers: original film has odd numbers, and duplicated film has even numbers. The red and green dot system is used here as well. “HAP” film is not listed as such in the rolls table, but it appears on work orders. The fact that naming conventions don’t match in the myriad of Oracle tables could prove confusing to people who don’t know our cataloging system and its history.

Scale:

Film in the vault is at a wide variety of scales. In actuality, each exposure on a roll will have a different scale. The catalog on the web site lists a nominal scale (what it was “supposed” to be) for different photo programs. This was generally 1:40,000 for the NAPP program, 1:58,000 for the NHAP program, and 1:20,000 for many of the earlier ASCS programs. The Rolls Table in the Oracle database lists the scale as calculated by quality inspection, or by the rectification process.

After the AT rectification was completed, an average scale for the roll was calculated from the ratio data entered into the Oracle database. The scales as listed range from 1:35,120 to 1:47,972 for the NAPP program, and 1:54,900 to 1:70,000 for the NHAP program. Film from the Forest Service and other programs is also at a wide range of scales.

During the quality inspection process, the contact prints were taped to a table and lined up with the correct overlap. The distance between the center points of the first and last print were measured with a tape measure, and the ground distance was calculated from known locations on the topographic maps. These figures were used to calculate an approximate scale for the roll, and these figures are listed on the inspection reports still on file in QA.

Film Quality:

Film in the vault is judged to be well intact, and with a shelf life that could exceed 100 years. Some of the older film may be more brittle. Over the years, Kodak improved the film to make it more environmentally friendly. Older film was silver nitrate, which is highly flammable. Film from those years was sent to the National Archives; they duplicated the rolls and destroyed the originals.

Handling the film could increase the risk of damage and lessen the value. Archival storage of the film would not pose a risk to the film’s chemical properties.

Printing from the archived film can cause damage the rolls. Processing the film through the enlargers can produce rips and scratches. Sometimes original film needs to be recovered from EDC and re-duplicated at APFO.

Film Value:

The cost of unexposed and unprocessed film ranges between $350 and $700 per roll. The imagery on the film is, of course, priceless.

Catalog Listing Issues:

The vault also contains some oblique angle photography, which is not listed in the catalog. It is often given a nominal scale of “0”. The Forest Service film is listed separately by Forest Region, and is not geo-referenced, or listed by location.

Another example of geographical confusion is the Dinosaur National Monument; it lies mostly in Colorado, but the headquarters and the Visitors Center are in Utah. (It is listed under Moffat County, Colorado.)

There are a number of instances of cross referencing, and situations where the two agencies used each other's film. One example is Klamath County, Oregon. "Forest Service" is listed in the title block, but it was also used by ASCS.(The film is listed through the Forest Service).

Many rolls of film and indexes are listed in the catalog as "FSA," even though they were probably flown as part of the ASCS, or other USDA, programs. This might prove confusing to people interested in accurate historical research.

The first national program was the National High Altitude Photography (NHAP) program, and was flown at a 1:58,000 scale. The film is listed as NHAP on the film cans, but as "HAP" on the film itself, and in some catalog listings. Inconsistencies in naming (another example is listing ASCS film as "FSA") can prove extremely confusing who might need historical accuracy when researching film and using it for historical assessments.

Indexes

A breakdown of the indexes is:

Photo Indexes	(PI)	65672	78.3%
Spot Indexes	(SI)	5027	6.0 %
Line Indexes	(LI)	10998	13.1%
"Digital" Indexes	(DI)	2178	2.6%

A more detailed listing is in Appendix 4, Indexes by Type.

Photo indexes were used until mid-1980s (start of the NHAP program). Many of these are in extremely fragile condition. In the catalog, over 120 are listed as being in very poor condition. These are generally from the mid-1950s.

Until the 50s or 60s, negatives often were not washed off well during the developing process. The surfaces of some indexes from that period look like broken glass, and might disintegrate on impact. It is questionable if they could withstand even one scan. Line indexes were also used from the 1950s through to the present.

The first spot index is listed in 1976. These display the center points of the imagery. They are stored on mylar, with paper or ozalid copies. Some of these are noted in the catalog as being in paper format only.

A “Digital” index is a bit of a misnomer; these were created by the photogrammetry section for projects from the late 1980s through the end of the NAPP program. They were created using AutoCAD, but the final output was a paper copy. The CAD files were backed up on 35mm tape, which are stored in an undisclosed location. They are not available in digital format.

A chronological breakdown:

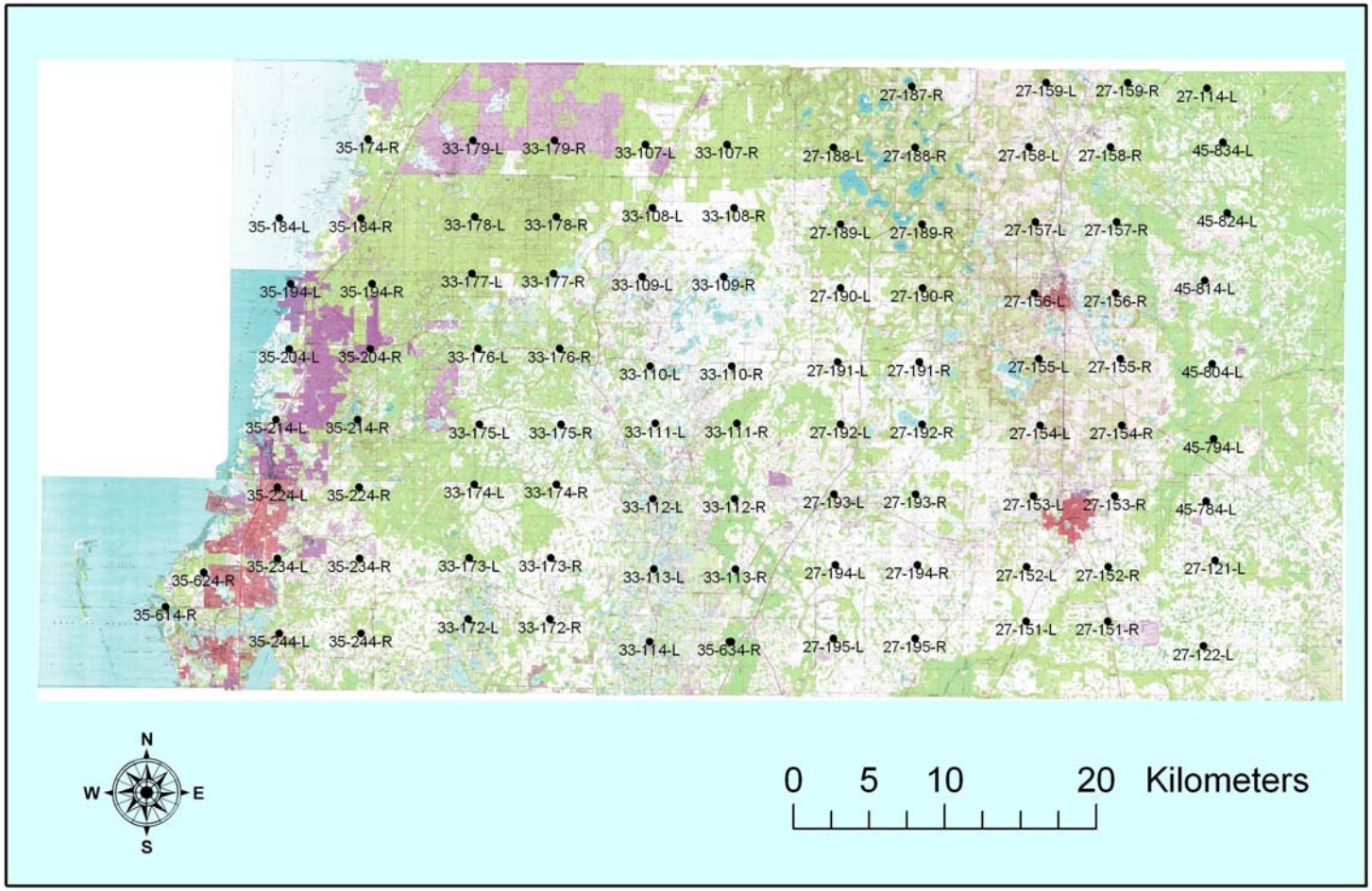
1950-1971	**48993**	
LI	3661	FS
PI	45259	
SI	73	62: FS
1972-1979	**17899**	
LI	2521	
PI	15367	
SI	11	
1980-1986	**8348**	
LI	1341	
PI	5040	ended 1984
SI	1967	
1987-1992	**5499**	
DI	429	
LI	2345	
PI	5	
SI	2720	
1993-1996	**2330**	
DI	1538	
PI	1	
LI	557	
SI	234	
1997-2004	**806**	
DI	211	
LI	573	
SI	22	

More detail is in Appendix 5, Indexes by Year.

In 2002, contractors were required to provide (electronic) center point data with the film. In 2004, the mylar indices were discontinued, and only electronic indexes were required.

Film for which center point data is available could have indexes made through Arc GIS, or some other program. Because the center points for imagery in these programs are stored in the Oracle database, it would be very easy to use this data to create shapefiles (or some other format) with index information. An example of this, with center points displayed over a DRG file, was made by David Davis.

Sources: David Davis, Jim Kniss, Robert Lear, Pete Parrish;
Kathy Casterline, SQL queries



This map was created at the USDA Aerial Photography Field Office in Salt Lake City, UT.

January 2004

Data: USGS Digital Raster Graph (DRG)
NAPP Photography Points

Pasco County, Florida

The EROS Data Center has created a records appraisal tool for use in evaluating items to be archived. Bob Lear has answered the questions relating to photography, as they relate to our collection. The records tool is located at:
http://edc2.usgs.gov/government/RAT/tool.asp

Are the records paper photographs?
All 9.5" x 9.5"records are on film.
Most of the line and photo indices are film. A few of these records are paper.

Are the frames on a polyester base? If not, what is the base?

The newer films are on an ESTAR Base with a gel backing. The absence of solvent in ESTAR base is one of the reasons films show excellent dimensional stability. In photography, dimensional stability applies to size changes caused by changes in humidity and in temperature, and by processing and aging.

What generation are the photographs? [term changed to "films" in answering the question]

The photo indices are third generation
9.5" x 9.5" films are first generation
Microfilm is fourth generation.
Aperture cards are fifth generation.

Rate the overall quality of the photographs [film] based upon proper exposure, color, balance, and sharpness.

The film is rated from good to excellent if these factors [above] have been controlled.

Do the frames contain clouds or haze?

Most of our film does not contain clouds. Less than 1% has a cloud cover. Haze exists in every aerial image. Variables such as filtration, visibility, and altitude have an impact on the lighting ratio when photographing from an aircraft. Aerial films have extended red sensitivity that helps to deal with haze.

Are the frames in roll format or single cut format?

99% of the images are on a roll; however, a few special projects are in a cut format.

Are the frames free from gross scratches, tears, pinholes, or dirt?

No, they are not free of imperfections.
Are the photographic rolls stored on reels securely enclosed in non-metal containers?

All rolls of film are on metal reels and are stored in either a plastic or metal container.
NOTE: Processed film is stored in a dark, dust free area at 50 to 70 degrees F, and 30 to 50 precent relative humidity. High relative humidity promotes the growth of mold and causes ferrotyping. Very low humidity causes excessive curl and brittleness.

Is the film type, camera type, camera focal length, lens number, date taken, flying height, and area of coverage available electronically?

Don't know.

Is the manufacturer number of the film available?

Yes, in the film reports.

Is the film titled with roll and frame reference numbers?

Yes.

Chapter 3: Uses for Historical Aerial Imagery

The uses of historical aerial imagery are many and varied. A quick search on the Internet, in GIS periodicals, or textbooks can result in hundreds of ideas for their use. In many cases, such as new road maps, the newest imagery possible would be needed. But in many other cases, historical imagery, or imagery over a range of years would be of more use.

A professor of Architecture and Urbanism at Yale University worked with an aerial photographer for her class. *Aerial Photography in Community Debates on Land Use* emphasizes visualization of the spatial landscape. In the section *Aerial Photography and Visualization*, they discuss bringing spatial issues to the general public through the medium of readily available aerial shots. (Dolores Hayden and Alex Mac Lean, site listed below)
http://classes.yale.edu/00-01/amst401a/guilford/essay.html

APFO's historical aerial photography collection can be of value to the federal agencies that flew the imagery or partnered in its acquisition; to state agencies, to universities, to private consultants, and to the general public. Making it easily available to the public would facilitate its use.

Going one step beyond the world of aerial imagery, dreamers in GIS development hope to some day have the "Z" factor (elevation) as an integral third dimension in a working GIS system. This can be used with existing technology to create 3-D visualizations. Time, or the historical factor, would be a fourth dimension in spatial analysis and modeling.

Because APFO's collection is an extensive historical record, it would, almost by definition, be in need of preservation. But there are many varied applications of the historical data for many different users. Because life is not static, but part of a continuum, looking at historical records is an essential part of decision making in the present.

APFO's film vault exists because aerial photography has been used for over half a century in the service of USDA farm programs. **Agricultural uses** would be the logical place to start in detailing uses of historical imagery

- *CLU/Farm Program History*

Digital imagery is being used by the FSA in the USDA Service Centers to administer farm programs. While the emphasis will always be on existing conditions, it may be necessary at times to check old records. Older imagery could help in locating older field boundaries. Someday they may even want to digitize historical CLUs! Historical imagery would also be useful in assessing former crop types.

- *Crop Conditions*

Aerial photography can be very useful in judging plant health. CIR imagery can be used in stress detection. This is, of course, something that only works if done repeatedly within a growing season, rather than after the fact. But a snapshot from a given point in the past might provide a baseline of "normal" conditions, or be used to verify a past problem.

- *Locating Abandoned Farmland*

In the eastern part of the country, farm land left fallow will quickly become populated with other species, and eventually revert to woodlands. Older imagery could be used to identify areas which had once been farmed, and might be again. Hampshire County, England used historical aerial photography to justify a plan for replacing wooded areas with farmland. http://www.historicairphotos.com

- *Locating Illicit Crops*

In the Smoky Mountains of Tennessee/North Carolina, rumor has it that the former moonshine stills deep in the mountains have been converted to marijuana patches. Aerial photography, especially CIR, could help spot this type of activity.

- *Soil Mapping*

Soil mapping is the province of NRCS, and is one of the GIS data layers used in the Service Centers. Many paper soil maps are superimposed on aerial photographs. Everyday use would dictate a need for the most recent imagery, but creating or verifying a digital version might benefit from historical imagery. The older imagery could be superimposed on the newer and compared with the soil map lines.

- *Use by Farmers*

Some farmers now use GIS with Global Positioning Systems (GPS) on their tractors to precisely plan their planting. This is, again, an application that needs new imagery, and at a larger scale than APFO offers. But the historical imagery might be useful to them for their own records and planning, especially if they rotate crops.

Landform change, or other changes in the natural environment, would be another area of study. Some of these might impact human activity, while others are in more remote locations. Some of these are caused by human activity. This application might also interact with studies of land use change.

- *Fluvial Landforms*

Thomas Lillesand and Ralph Kiefer, in *Remote Sensing and Image Interpretation,* list a number of uses for aerial photography, many of which would benefit from a historical approach. Landforms created by flowing water include alluvial fans, floodplains, and deltas. Some applications of studying these landforms might be:

1. Analyzing locations of and change in alluvial fans before planning development. Shifting alluvial fans have destroyed parts of the Alaska Highway, and have damaged subdivisions in California and Colorado. (Lillesand and Kiefer, 280).

2. Floodplain analysis also needs to be done before development takes place. This is an area that should be very important to farmers, who may wish to plant on low lying areas. A good example was seen in creating the MDOQs; in one area of Oklahoma, a river had changed course dramatically between the date of one DOQQ's acquisition and that of the one adjacent to it. The two images would not "line up" because the new riverbed had moved too far from the old one. (This also points out a need to have accurate imagery from the same time period/acquisition project)

3. Deltas and sediment deposition can also be looked at on a temporal scale. The Mississippi Delta is especially critical because the sedimentation level is dropping, and the delta eroding. This poses a particular hazard for New Orleans. The same problem is occurring in the nearby Atchafalaya delta.

4. Reservoir sedimentation is technically not a "fluvial landform" issue, but is included here because the sedimentation is a natural process. Sedimentation is, to varying degrees, a problem behind many human made dams. In the Ocoee River of Tennessee, down stream from the Copper Basin described in the next section, sedimentation is a severe problem, especially in Dam #3. Sedimentation in the dams was the motivating factor behind TVA's initial revegetation project. In Tennessee the sedimentation impacts electricity generation, but in arid parts of the country it might impact water used for irrigation.

5. Changes in drainage patterns would have obvious consequences for humans, for agriculture, and for natural resources management. This is something that can traced on historical imagery. An NRCS officer in Oregon recently contacted APFO requesting historical imagery for a geomorphological study on stream networks.

- *Landslide Studies*

Time for Change: Quantifying Landslide Evolution Using Historical Aerial Photographs and Modern Photogrammetric Methods, by Walstra, Chandler, Dixon, and Dijkstra, documents their studies in assessing past landslide activity. The goal is to predict future climate (i.e., from global warming) induced landslide activity in the U.K. with the aid of historical imagery.
http://www.isprs.org/istanbul2004/comm4/papers/395.pdf

- Aeolian (wind created) landforms and Glacial landforms, also mentioned in Lillesand and Kiefer, would probably not be areas of historical study in the U.S.

Environmental Enforcement uses aerial imagery in investigations

- *Environmental Protection Agency National Enforcement Investigations Center*

Carrie Middleton, in the website cited below, describes the use of aerial imagery in the course of an investigation – for targeting and prioritization, change detection, "virtual field reconnaissance", evaluation, and in court. Historical imagery could play a role in investigations involving past conditions or abuses.

http://www.isprs.org/commission1/proceedings/paper/00045.pdf.

Water Resources is an area that could benefit greatly from historical imagery.

- *Point Source Pollution*

Areas of point source pollution can be spotted on aerial photography by dispersed plumes of lighter color spreading out into the water. This analysis would need to be backed up by water samples. (Lillesand and Kiefer, 207)

- *Nonpoint Source Pollution*

Measurements of impervious surfaces could be used to help analyze the amount or runoff from potentially toxic surfaces such as parking lots, waste dumps, or fields covered with pesticides.

- *Oil Slicks*

Oil deposits on water also have a distinctive signature. They are best seen with natural color photography.

- *Lake Eutrophication*

Eutrophication occurs when lakes are choked with weeds or algal blooms. These can be studied with aerial photography, but might be better addressed with smaller, low altitude, custom flying.

- *Wetlands Mapping*

Wetlands have been recognized as extremely important features in maintaining a healthy ecosystem. They are identified by hydrophytic vegetation, hydric soils, and wetland hydrology. (Lillesand and Kiefer, 219). A study in changing wetlands can be seen in APFO's own imagery of the nearby Decker Lake, which once extended as far as our building. A closer examination of the historical photography (as well as noticing things like the cattails out back) could delineate the natural wetland that still underlies this developed area.

Land use change is one of the most frequently cited applications of historical analysis. This is a heading that could include environmental protection and restoration activities. These are a few of many possible examples:

- *Comprehensive Everglades Restoration Project (CERP)*

USGS is assisting in this large cooperative effort by providing orthorectified historical aerial photography to aid in "resource planning and scientific inquiry." Their goals for 2004 included the creation of a mosaicked dataset from 1940. CERP is a program to restore the fragile Everglades ecosystem and protect water resources in central and south Florida. It

includes over 60 major components, and has a number of partners. Project leaders for the aerial imagery component are Tom Smith, Ann Foster, and John Jones.
http://sofia.er.usgs.gov/projects/digarchive_aerial/

- *Coastal Erosion Studies*

Kenneth Connell and Gary Zarillo describe the use of a historical photoset to analyze change in inlets and shoals on Long Island. This analysis, done with an ArcView extension, provides a quick method for assisting in maintenance of tidal inlets and channels. These are necessary for navigation – commercial, defensive, and recreational – as well as shoreline and habitat preservation.
http://cirp.wes.army.mil/cirp/cetns/InletGiS_CHETN-draft.pdf.

The Aero Data Corporation in Louisiana used historical imagery to study coastal erosion along the Gulf Coast. It has also done environmental analysis with historical imagery, locating old waste pits, chemical spills, and problematic oil fields.
http://www.kodak.com/eknec/PageQuerier.jhtml?pq-path=2608/2609/4123/6310&pq-locale=en_US

- *Revegetation Studies; Restoration of a Damaged Landscape*

The Copper Basin in southeastern Tennessee was stripped of all vegetation before 1900 as a result of copper smelting and sulfur dioxide pollution, as well as open range grazing. The Tennessee Valley Authority began attempts to replant trees in the 1940s, but the core area, eroded to bedrock, resisted improvement. Later attempts also proved futile until the 1990s, when some newer techniques succeeded in re-establishing a tree cover. Historical aerial photographs were used to analyze patterns of re-growth, and to plan tests of runoff, sedimentation, and organic carbon in the soil. (L. Mathews, 1995 M.S. thesis)

- *Identifying Abandoned Waste Disposal Sites*

Cornell University's Institute for Resource Information Systems used its historical photo collection to locate residences in Suffolk County NY (Long Island) that were on or near abandoned waste disposal sites. Photos from 1947, 1962, and 1972 were used to identify old mines in the area that had been converted into dumps before they were paved over. Cornell is also studying submerged aquatic vegetation in the Hudson River. (Article by Roger Segelken)
http://www.news.cornell.edu/Chronicle/03/12.11.03/IRIS_photos.html

Geoffrey Carton and Steve Baker describe a client who was able to use aerial photography to locate old disposal sites – including a few that were not documented. Previous geophysical investigations had been unable to locate the sites. The authors also give instruction in what to look for on aerial photographs, and make a plug for hiring a skilled photo interpreter.
http://www.pollutionengineering.com/CDA/ArticleInformation/features/BNP__Features__Item/0,6649,110584,00.html

- *Human History*

The most obvious land use change comes from human impact on the landscape. The Yale example cited above takes the visitor through of quick tour of Guilford, Connecticut. Dealing with urban sprawl is one possible application of historical photography. High altitude photography might not be as accessible for community planning activities as lower altitude or oblique shots, but it could still make a contribution. Demographics could also benefit from seeing the spatial layout of homes, businesses, and transportation arteries as they change over time. This is an application that would be relevant to USDA's Rural Development agency.

- *Population Estimates and Housing Quality Studies*

Estimates of population can be made from aerial photography by establishing an average family size per housing unit, counting houses, and calculating a population. Housing quality estimates are made based on such factors as house and lot size, presence of driveways and garages, street conditions, location, and yard size and condition. Color infrared is well suited for judging vegetation condition. (Lillesand and Kiefer, 215)

- *Traffic and Congestion*

Vehicle spacings and distribution could be used to assess changes in congestion in urban areas. Lower altitude photography would be better, and the researcher would need to be careful of the time of day and day of the week when the photography was flown. (Lillesand and Kiefer, 215)

Wildlife or Forest Census Taking

- *Wildlife Census*

Although somewhat problematic, aerial imagery has been used in wildlife censuses by using a grid, estimating the number of individuals in a grid, and multiplying by the number of occupied grids (similar to human population estimates). Computer programs could do some of the counting, but the human eye would be needed for decision making. Lillesand and Kiefer show examples of imagery used to count prairie dog colonies and beluga whales (pp 227, 228)

- *Forestry Census*

Trees can be counted using the same methodology. This is used for different species of trees; an example was a count of deciduous and evergreen trees in the Great Smoky Mountains National Park.

Archeaological Use

- Lillesand and Kiefer show some fascinating aerial photographs showing the outlines of Nazca lines in Peru, the ancient city of Spina, Italy, and a Roman villa in northern France. Older imagery, with less human development, might display these features more clearly. This could be useful in locating native American sites in the U.S.

Site Selection

- GIS is at its best when different layers of data can be overlaid for decision making purposes. Good examples of overlay analysis are determining locations for things no one wants around, like garbage dumps: they need to be away from water sources, habitations, roads, etc. Creating a series of buffers around features and establishing other spatial rules can be used to eliminate areas from consideration. Historical photography might generally be irrelevant here, except in cases where a historical site or area would need to be isolated from the proposal area.

Land Use Mapping

- The USGS has a classification system of *Land Use/Land Cover for Use with Remote Sensing Data* (Lillesand and Kiefer, 172). Someone wanting to create a temporal series of classification maps for a GIS application or display would need to refer to historical imagery in digitizing the areas. Aerial imagery would be crucial in creating vector data for GIS overlays. Historical imagery would play a role in any type of vector data creation for a past year.

Industrial Use

- Wayne Grip, of the Aero Data Company in Louisiana, reports that oil companies will request historical imagery before buying an oil field. They are interested in locating old well heads, tank farms, brine or reserve pits, and possible environmental problems. This would probably be the case with other extractive industries, as well.

Unusual Applications

- *History*

The Stennis Space Center is collaborating in a project to use space imagery in locating some of the Lewis and Clark expedition's campsites.
http://www.geospatial-online.com/geospatialsolutions/article/articleDetail.jsp?id=68392&sk=&date=&&pageID=1

- *Humanitarian Service*

A team at James Madison University in Virginia, led by Sam Samuel of Star Mountain, Inc, has used aerial photography to aid in locating landmines on old battlefields in Cambodia and Bosnia. Fortunately this is not an application relevant to the U.S. or our photography, but the lessons they learn might someday have a use for some application closer to home.
http://maic.jmu.edu/journal/2.1/gustafson.htm

The General Public

It is difficult to put the many uses of imagery into discrete categories, since so much in life and the environment are interconnected. Many of the applications described above could also be important to **non-technical users**. This is the audience the Yale class is trying to reach. Of specific interest to the general public might be:

- *Community Planning and Information*

In Guilford, Connecticut, a visual essay on the town's developmental history is presented, along with the basic arguments for the town's future. (Hayden and MacLean, *op cit*.) The authors feel that aerial photography could be widely used in community decisions by posting it on websites. They actually advocate oblique angle photography as being more "user friendly" for non-technical users. But vertical historical imagery is obviously necessary for the more distant past. Advances in GIS display technology might also make 3-D visualization from historical imagery a possibility online.

- *Educational Use*

School teachers could use historical imagery to teach a wide variety of lessons, including land use change in their own neighborhood. ESRI often provides software and other GIS tools to help schools that incorporate GIS into the lesson plans. University students, even in fields other than geography, might find uses for historical imagery in their own disciplines.

- *Personal Historical Records*

Individuals may want to have a record of their hometown, old family farm, or other important area "as it was" in their childhood or before development moved in. This could be useful for genealogists looking for older locations. For example, one may find that a birthplace exists now just as an intersection on an old topographic map. Looking at historical imagery might allow a researcher to visualize how the place looked in earlier times, and then relate the location to present land use.

- *Real Estate Issues*

Studying old aerial photography might help a homeowner to realize the nature of the property before it was developed. They may find that it used to be a wetland or lies in the center of a drainage basin. An article by Terry Slonecker, Mary Lacerte, and Donald Garofalo, *The Value of Historical Imagery* (website listed below), discusses the value of aerial imagery in hazardous waste site analysis. They give a scenario of a neighborhood sickened by contaminated water. Checking previous land use might become an important step before buying a home.
http://www.eomonline.com/Common/Archives/1999julaug/99julaug_airborne.html

- *Outdoor Activities*

Aerial photography can be useful for hunters, hikers, or anyone venturing into more remote terrain. This is an area where recent paper photographs might be more useful, but many prints could be made from a digital image. Outdoor enthusiasts might also have some reasons for wanting older imagery of their favorite areas (such as locating an old camping spot).

- *Personal Enjoyment*

This can cover a multitude of uses!

This is only the beginning. As aerial photography becomes more accessible, and computer use more ubiquitous, the uses will certainly multiply.

Chapter 4: Who Uses Our Imagery?

APFO's historical film library exists primarily because of the need to serve FSA farm programs. This is reflected in the composition of the holdings. 43% of the rolls are Black and White ASCS film. Another 13% are from the national programs, NHAP and NAPP, in which FSA partnered. This imagery was also used in administering programs.

The second largest part of our collection is Forest Service film. This is consistent with APFO's role as the contractor for Forest Service imagery. Although the Forest Service is also moving to the use of digital imagery, "Contracting Obligations" remains a large part of our work orders.

Analyzing customer needs and future purchases is probably the most inexact part of a study such as this. Without a crystal ball, it is difficult to predict what will be needed in the future. But in looking at the reports, two initial patterns emerged. These can be seen in Appendix 7, *Work Orders by Year, 1954-2004.* In this summary the customers are divided into four groups: APFO, Other Federal Agencies, the Non-Federal Public, and State Governments. "State" can also include state-run universities.

In looking at this chart, it is obvious that the bulk of the work orders submitted in the time frame of January 2002 through December 2004 came from the years 2001 – 2004. Nearly 70% of work orders for these three years came from imagery flown during these three year. This would be expected, because it reflects the expected work flow of this office as we performed the tasks assigned to us. During these three years, the largest number of work orders and total units ordered were from APFO internal operations. A large part of the orders also came from other Federal agencies, especially the Forest Service. Again, this would be expected, since APFO contracts flying for the Forest Service. This effort is also reflected in the category "APFO Contracting Obligations," which I included with APFO internal orders.

Appendix 8, *Work Orders by Customer*, gives a listing of the number of Work Orders submitted and Units requested by all APFO's customers. A summation of this chart is shown below.

Summary:	**# WOs**	**% WOs**	**# Units**	**% Units**
APFO	1,016	6.13	38,2526	**46.53**
Federal	3,492	21.06	309,524	37.65
Public	10,928	**65.90**	77,053	9.37
States	1,147	6.92	52,916	6.441
Total	16,583	100	822,019	100

A listing of the main customers for this entire time period is shown below.

Main Customers by Work Order	
Public Non-Federal	**65.90**
FSA	8.08
NASS	3.25
Forest Service	3.01
APFO Director	2.73
NRCS	2.07
EPA	1.34
BLM	1.28
APFO GSB	1.06

Main Customers by Units	
APFO Contract Oblig.	**37.37**
Forest Service	**24.65**
Public Non-Federal	9.37
APFO Director	6.61
NRCS	4.02
BLM	2.89
FSA	1.79
NASS	1.17
APFO GSB	1.13

(Notice that the Forest Service and APFO Contracting Obligations together comprise 62% of all units produced.)

A quick look at the chart above verifies the first obvious point: Most of the units produced within the last three years were for APFO's contractual obligations from those years. The second finding was perhaps less expected. The total number of work orders submitted came overwhelmingly from the general public. The number of actual units requested from the general public was not as high as the work order requests. Again, this would be expected: individual customers, especially non-commercial ones, would not have a need for large quantities of imagery.

1992 – 1993 was chosen as a break point in looking at work order patterns. This was done because 1993 was the first year for which the number of units requested was greater than 1% of the total. A breakdown of customer requests from 1993 to the present can be seen in Appendix 9, *Work Orders by Customer 1993 - Present*. A summation of this chart is shown below:

Summation Customer	**# Work Orders**	**% WO**	**# Units**	**% Units**
APFO	902	11.10	377,570	**52.45**
Other Federal	1,909	23.49	274,045	**38.07**
Public Non-Federal	4,995	**61.47**	37,081	5.15
States	320	3.94	31,148	4.33
Total	8,126	100	719,844	100

Here the two points are well illustrated. Most of the work orders came from the general public, but most of the units ordered were for APFO internal requests, or from other agencies. Those two combined totaled around 90% of all units requested. The largest customers from these years are shown below:

Main Customers By Work Orders	# of Orders	% of Orders
Public Non-Federal	4,995	**61.47**
FSA	634	7.8
NASS	452	5.56
APFO Director	406	5
Forest Service	372	4.58
BLM	168	2.07
APFO GSB	149	1.83
APFO Contr. Oblig	148	1.82
NRCS	132	1.62
APFO SC Support	90	1.12

Main Customers by Units	# of Units	% Units	
APFO Contr. Oblig	307197	**42.68**	69.99
Forest Service	196598	**27.31**	For both
APFO Director	53725	7.46	
Public	37081	5.15	
BLM	23364	3.25	
NRCS	15634	2.17	
USGS	11303	1.57	
FSA	11242	1.56	
NASS	9262	1.29	

Once again, we see that APFO Contracting and the Forest Service combined resulted in nearly 70% of all units requested. The percent of work orders requested by these two customers, at 6.4%, didn't come close to the percentage of units. With the general public, the pattern is the opposite; they accounted for over 61% of total work orders, but only about 5% of the total units produced.

The chart of work orders for imagery which was flown from 1954 through 1992 shows a very different picture. This is shown in Appendix 10, *Work Orders from 1954 – 1992.* A summation of this chart is shown below:

Summation	# Work Orders	% WO	# Units	% Units
APFO	114	1.35	4956	4.85
Federal	1583	18.72	35479	**34.72**
Public Non-Federal	5933	**70.15**	39972	**39.12**
States	827	9.78	21768	21.31
Total	8457	100.00	102175	100

Here the percent of work orders from the general public is even higher, at over 70%. The public also leads in the number of units requested. The percentage of units requested by state governments is also much higher than in the previous charts. The largest customers from these years are listed below:

Largest Customers by Work Orders	**# of Orders**	**% of Orders**
Public	5933	**70.15**
FSA	706	8.35
NRCS	211	2.49
EPA	197	2.33
Forest Service	127	1.5
New Jersey	124	1.47
NASS	88	1.04

Largest Customers by Units	# of Units	% of Units
Public Non-Federal	39972	**39.12**
NRCS	17446	17.07
Forest Service	6006	5.88
FSA	3439	3.37
Iowa	3302	3.23
APFO GSB	3041	2.98
BIA	2674	2.62
Utah	2623	2.57
EPA	1659	1.62
Florida	1653	1.61
California	1549	1.51
U.S. Army	1507	1.47
New Jersey	1494	1.46
Illinois	1494	1.46
Arizona	1108	1.08
Montana	1052	1.03

Several individual states also feature in the standings here. These orders are, of course, much smaller than the “industrial strength” orders placed for the purpose of running federal programs. But they can give some idea of areas of interest.

A next question might be whether digital products might be in demand by the general public. A look at requests for digital imagery from the NAIP or NDOP programs is not encouraging. Requests for imagery from the public – and from the states – is minimal, and most of the work orders were from APFO and other federal users. Perhaps with more time, and GDW availability, the word will get out, and the public will want to use the imagery. Perhaps bundling demo imagery on CDs along with viewing software could expand public interest in digital imagery. Work orders for digital imagery is shown in Appendix 11, *Digital Imagery Orders:*

As of Spring 2005, the public's interest in ordering CLUs and NAIP imagery is rising. We hope to receive more orders for this imagery from the public.

Summation	# Work Orders	% Work Orders	# Units	% Units
APFO	3692	47.85	102594	63.35
Other Federal	3500	45.37	52917	32.67
Public Non-Federal	363	4.71	3041	1.88
States	160	2.07	3403	2.01

Main customers for digital imagery are listed below As expected, APFO internal orders and FSA were the bulk of requests:

Largest Customers by Work Order	Work Orders	% Work Orders
FSA	3452	44.74
APFO Partnership	1969	25.52
APFO GSB	1596	20.69
Public	363	4.71
Kansas	108	1.4

Largest Customers by Units	# of Units	% of Units
APFO Partnership	52652	32.5
Farm Service Agency	50549	31.21
APFO GSB	45623	28.17
Public	3041	1.88
APFO Director	2671	1.65
Fish and Wildlife	1676	1.03

Appendix 12, *Digital Work Orders Without APFO and FSA,* is a listing of digital imagery requests with APFO internal orders and FSA removed. This shows a much more even distribution of requests.

Summation				
Other Federal	48	8.406305	2368	26.87245
Public	363	63.57268	3041	34.50976
States	160	28.02102	3403	38.61779
Total	**571**	**100**	**8812**	**100**

The main customers were:

Largest Customers by Work Orders	# of Orders	% of Orders
Public Non-Federal	363	63.57
Kansas	108	18.91
Bureau of Indian Affairs	9	1.58
Fish and Wildlife Service	8	1.4
Forest Service	7	1.23
Wisconsin	6	1.05
National Park Service	6	1.05
Bureau of Land Management	6	1.05

Largest Customers by Units	# of Units	% of Units
Public Non-Federal	3041	34.51
Fish and Wildlife Service	1676	19.02
Minnesota	1034	11.73
Vermont	805	9.14
Utah	788	8.94
Forest Service	278	3.15
Kansas	225	2.55
Missouri	142	1.61
Iowa	131	1.49
National Park Service	125	1.42
Office of Surface Mining	110	1.25
Bureau of Indian Affairs	108	1.23

I was also provided with some information from the misc and dmisc listing, detailing scanning orders and other miscellaneous orders. Investigating these would require more detailed searches into the menu system.

At present, the photography branch at APFO is doing custom scans for anyone who requests them. All requests are different, and the customer does not have to pay any set-up fees. Media costs and shipping are also included in the price of the scans.

The scanners at APFO have a 10,000 unit workload. They are able to do 2500 scans a month. It is estimated that scanning the film library using our photogrammetric scanners would take over 50 years.

The largest number of scanning orders come from other government agencies, such as the Forest Service and NRCS. Orders also come from USGS, universities, state governments, consultants, and other non-federal users. Other agricultural agencies are permitted to send their film to be scanned at APFO.

Film scanned at APFO is not georeferenced (unless this is specifically requested and approved). The old ASCS film in the vault does not have any georeferencing information, and this would need to be obtained in order to use the imagery in GIS. It also would be needed if some sort of electronic indexing were to be developed.

Scans done for individual customers are not saved or archived. Because they are at different resolutions, in different formats, and of different sized areas, they would not fit into a standard archiving system. A program to scan the imagery for archiving and distribution to the public would need to be carefully planned, with standards set. There would also be a need to create metadata. The actual scanning procedure would have several steps: the scan itself, image enhancement (Photoshop was recommended), and georeferencing.

Source: Robert Lear; SQL Query, Kathy Casterline, Linda McDonald

Chapter 5: Assessing the Need to Archive

Many different arguments could be put forward for or against preserving the imagery. This chapter deals with both sides of the issue, as well as some evaluation criteria.

Arguments for Preservation

A. Risk of Damage:

Example 1.
The Illinois Historical Aerial Photography project has a large collection of paper photographs, which they are archiving to prevent further damage. ILHAP's concern in digitizing is somewhat different from ours; they have only paper photographs in their collection, while we have the actual archived film

From the Illinois Historical Aerial Photography project:

> Unfortunately, the increased use of these aerial photographs has resulted in an undetermined number of prints becoming faded, worn, defaced, or lost. As a result, access to these unique print collections is becoming increasingly restricted. It is critical that the single best set of these prints be preserved in a permanent digital archive to ensure their availability for future users. The primary objectives of the Illinois Historical Aerial Photography project are to develop and provide Internet access to this digital archive.

The Illinois Historical Aerial Photography project is a part of the Illinois State Geological Survey, which runs its own Natural Resources Geospatial Data Clearinghouse. The primary goal of the Illinois Historical Aerial Photography (ILHAP) project is to create digital archival surrogates for the 1936 through 1941 USDA-AAA aerial photographs. *Since the original silver nitrate negatives no longer exist, the photographic paper prints produced from the original film negatives must be digitized.*
http://www.isgs.uiuc.edu/nsdihome/webdocs/ilhap/scan.html

Another Illinois Geological Survey project involves scanning and orthorectifying imagery from the 1930s and 40s.

> Most of the photographs come from the Illinois Department of Natural Resources Office of Water Resources, which has an extensive collection. That collection has suffered through the years, though, from use and loss, and photographs are now transported using security measures to avoid further loss.

.

Example 2:
The University of Illinois has a good Power Point presentation documenting their rationale for digitizing their photography collection.
http://images.library.uiuc.edu/projects/aerial_photos/information/slideshow/sld001.htm

They have a collection of old photographs, most from silver nitrate film. The original film has been destroyed, and the paper copies are their only record. Making a digital copy would be the best way to preserve these records.

Example 3:

Utah, according to geologists, is overdue for the "big one," meaning a major earthquake. Even if the building could withstand the tremors, the fact that this area is a natural wetlands might make water damage a possibility. Fire or other natural disasters are also a possibility.

B. Greater Accuracy of Ortho Rectified Imagery:

When flown, the imagery rarely would be at the precise scale defined by the program. The range of average scales for each roll of film is listed in the Oracle database. For the NAPP1 program, for example, the 1:40,000 "official" scale actually fell between 1:35,200 to 1:47,972. Within a roll, individual exposures would also have differing scales. The rectification process for the photo enlargements corrected this problem. Orthorectification could provide more geometrically accurate imagery over a larger continuous area.

Example 1:
This point is illustrated well by the Hennepin County, Minnesota website, explaining the basics of orthorectification..

http://www.co.hennepin.mn.us/vgn/portal/internet/hcdetailmaster/0,2300,1273_83317_102898005,00.html

Geometrically accurate imagery probably would not be necessary for many customers. However, it would be easier to rectify on demand if the exposures were already scanned and available for processing.

Example 2:
The Illinois State Geological Survey has scanned and orthorectified aerial imagery from the 1930s in four watershed areas. Their rationale is that orthorectifying geometrically corrects the scanned images to provide accurate locations, and includes the vertical dimension.

http://www.isgs.uiuc.edu/annulrpt/ar01_02/g15.htm
C. Past Value of Historical Collections Make Future Usage a Certainty

Example1:
From *Airborne: The Value of Historical Imagery*
By Terry Slonecker, Mary J. Lacerte, and Donald Garofalo

The information contained in the vast holdings of historical imagery has already made many meaningful contributions to scientific discovery and resource management. This will no doubt grow as the rapidly expanding world of remote sensing technology creates unprecedented volumes of overhead imagery from a variety of sensors and platforms. Increases in spatial and spectral resolution will spawn many new and unforeseen uses of imagery.

Creating permanent, digital archives of existing historical imagery collections should be a high priority for the remote sensing and scientific communities. In concert with the acquisition of imagery, comprehensive and searchable metadata files must be generated and maintained. Further, great care should be taken to preserve this capability by creating reliable physical storage systems to ensure efficient access to these new imagery resources.

Historical imagery is a unique and irreplaceable resource. We should always keep in mind that imaging scientists have a unique capability to view the past and we, as a community, should take great care to preserve this resource for future generations.

http://www.eomonline.com/Common/Archives/1999julaug/99julaug_airborne.html

Example 2:

Data Science Journal, Volume 2, 31 October 2003 159

The Challenge of Archiving and Preserving Remotely Sensed Data

By John L. Faundeen
Archivist, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 57198 USA

Abstract

Few would question the need to archive the scientific and technical (S&T) data generated by researchers. At a minimum, the data are needed for change analysis. Likewise, most people would value efforts to ensure the preservation of the archived S&T data. Future generations will use analysis techniques not even considered today. Until recently, archiving and preserving these data were usually accomplished within existing infrastructures and budgets. As the volume of archived data increases, however, organizations charged with archiving S&T data will be increasingly challenged (U.S. General Accounting Office, 2002). The U.S. Geological Survey has had experience in this area and has developed strategies to deal with the mountain of land remote sensing data currently being managed and the tidal wave of expected new data. The Agency has dealt with archiving issues, such as selection criteria, purging, advisory panels, and data access, and has met with preservation challenges involving photographic and digital media. That experience has allowed the USGS to develop management approaches, which this paper outlines.

http://journals.eecs.qub.ac.uk/codata/Journal/contents/2_03/2_03pdfs/DS132.pdf

D. Technological Obsolescence Will Necessitate Moving to Newer Media

Example 1:

Data Science Journal, Volume 2, 31 October 2003 159

The Challenge of Archiving and Preserving Remotely Sensed Data

By John L. Faundeen
Archivist, U.S. Geological Survey, EROS Data Center, Sioux Falls, SD 57198 USA

> Technological obsolescence is one of the biggest digital data challenges to a records manager (U.S. General Accounting Office, 2002). Media, hardware, and software all become obsolete. An earlier rule of thumb was that data residing on a media needed to be migrated to a next-generation media every 10 years. Although general in nature, the 10 years usually provided enough lead-time to accomplish data migrations. Today, technology is moving faster, causing the 10-year window to shrink. Five years has been discussed in various archiving circles as a more realistic period for digital data. The USGS has designed, built, and operated three data migration systems. These complex systems migrated the digital scientific data from aging to newer media and cost millions of dollars while spanning many years. The successful operation of these migrations ensure that the data will be available for researchers. A fourth system is being built to handle previously migrated data to yet another media. The cycle continues. Planning for these preservation activities is extensive and must be done before data are threatened.

http://216.239.57.104/search?q=cache:EQhqj9QuNdwJ:journals.eecs.qub.ac.uk/codata/Journal/contents/2_03/2_03pdfs/DS132.pdf+Preserving+Aerial+photography&hl=en

Because technology is moving so rapidly, it will be necessary to change the archival media. Film may last for over 75 years, but for the older film, a good deal of that time has already passed.

Example 2:

Stewart Taggart, writing for space.com, describes the spatial data glut, and the rush to deal with it. NASA's Jet Propulsion Laboratory has moved from digital linear tapes (DLT) to CDs to DVDs. Joseph King, of the National Space Science Data Center in Greenbelt, MD reports a continuous challenge in data storage, as they continually move from one media to another. John Faundeen, at the EROS Data Center, says he "must keep running just to stand still." Moving to a digital storage media may be necessary to ensure the data's preservation for the future.

Of course, their imagery was not originally captured on film, so they never faced the question of considering a move from analog to digital.

http://www.space.com/scienceastronomy/generalscience/satellite_archives_000913.html

Arguments Against Preservation

Cost:

The Illinois project has been curtailed die to a lack of funds. They write:

> Assistance from federal, state, and local governmental agencies, and non-governmental organizations will be required to continue the preservation of Illinois 1936 through 1941 USDA-AAA aerial photographs and provide access to the digital collection. No further file scanning activities are being undertaken at this time.

http://images.library.uiuc.edu/projects/aerial_photos/information/overview.asp

It could be argued that the cost may still be too high, especially in a time when budgets are tight. It might be better to wait until archival methods are less expensive and more durable.

Shelf Life:

Film has a longer shelf life than digital media. The cans of film in our vault have lasted for 50 years, could probably last for 50 more, and still be in good condition. Kodak representative Douglas A. DeGraaf, in a presentation to the NAIP planning meeting (September 16, 2004), stated that film is archival for up to 75 years, with less than 10% dye fade.
http://www.apfo.usda.gov/naip/Kodak.pdf

Court Usage:

Film versions of aerial photography are admissible in court. Digital imagery is not, because it could potentially be altered.

Technological Obsolescence Will Necessitate Moving to Newer Media

This point was made in the “Arguments For” section. It could also be argued that since film has a longer shelf life, it would be better to keep the imagery archived in its original format, rather than moving to a digital method that will probably need to be updated in a short period of time, and then updated again for an even newer format.

Scale Accurate Photography May Be a Low Priority

Dolores Hayden and Alex MacLean, in a website through Yale University, explore issues in the urban landscape of Guilford Connecticut. Their abstract reads:

> Low-altitude, oblique-angle aerial photography offers easily understood documentation of town character and cultural landscape history. Aerial photography shows scale relationships well, and is especially useful for visualizing resources in older towns. Guilford, Connecticut, founded in 1639, offers an example of a town with four historic districts threatened by automobile-scale sprawl. Our website makes broad dissemination of color aerial photographs affordable. It carries extensive text and maps as well to encourage debate on land use among citizens, planners, and elected officials.

They emphasize the use of oblique angle photography, and dismiss conventional, vertical aerial photography in saying

> These [9" x 9" high resolution photography (*sic*)] were taken at 90 degrees to the ground, and were not easy to read. This was always an expensive format as well as a rigid one, and any shift to color photography only increased the expense of reproduction.
>
> Better images for a non-technical audience come from professional photographers who fly small planes, zooming in at oblique angles and varying altitudes, using 35mm cameras and different lenses. The format is versatile and more expressive.

Many users, even in an academic setting, might not see the need for scale accurate photography, or even for high resolution digital images.

http://classes.yale.edu/00-01/amst401a/guilford/aerialphoto.html

Assessment Questions

The USGS has an online form for appraisal of the value of its records. Four of their primary considerations are the authenticity, reliability, integrity, and usability of the data. The questions asked on this form could be modified for use with our unique collection. http://edc2.usgs.gov/government/RAT/tool.asp

The questions specifically about photographs are:

Are the records paper photographs?
Are the frames on a polyester base? If not, what is the base?
What generation are the photographs?
Rate the overall quality of the photographs based upon proper exposure, color, balance, and sharpness.
Do the frames contain clouds or haze?
Are the frames in roll format or single cut format?
Are the frames free from gross scratches, tears, pinholes, or dirt?
Are the photographic rolls stored on reels securely enclosed in non-metal containers?
Is the film type, camera type, camera focal length, lens number, date taken, flying height, and area of coverage available electronically?
Is the manufacturer number of the film available?
Is the film titled with roll and frame reference numbers?

The entire questionnaire is available as Appendix 6, Records Appraisal Tool.

The Illinois State Geologic Survey has been working slowly due to funding constraints. They have sought partnership opportunities in developing their library. They write:

> Archiving is prioritized depending on availability of funding; most of the cost incurred is for optical scanning. The Illinois Department of Transportation, which is required to conduct site assessments for any new road construction or improvement, contributed toward the archiving the images acquired in the Chicago and St. Louis Metro East areas.
>
> Future funding is not assured, but ISGS staff are working to find funds to continue the project. The ISGS recently received a grant from the U.S. Army Corps of Engineers to develop a Web site to provide wider access to the collection. The present archive contains 9,000 scanned aerial photographs from the late 1930s and early 1940s

http://www.isgs.uiuc.edu/annulrpt/ar01_02/g15.htm

Archiving Options

Before beginning an archiving program, a number of different options would need to be explored. These would include what type of products should be provided, what type of format, what areas, and what time series.

David Davis provided a list of historical imagery options to be considered.
They include:

Products:

- Custom made areas. This is the method being used at present, where imagery is scanned on demand for the area, format, time series, and media that the customer requests.
- Pre-made areas. APFO could create products for areas where we anticipate a higher demand. This might be determined by factors such as high land use/change; large populations; industries that use imagery; areas of environmental sensitivity.
- Time series. APFO could provide imagery of a city, metropolitan area, or county over a period of time, using all imagery for that area available in the vault.
- Should pre-made coverages be by county (similar to the present CCMs), city, metropolitan areas, or by customer designated areas.

Geographical Reference:

- Scanning only: scan imagery, either according to a set standard or at a resolution and format specified by the customer. This would not be georeferenced; the customers would need to do that themselves. Camera reports could be supplied upon request.
- Georeferenced: a specified number of control points could be provided, and the images would need to be "rubber sheeted" by the customer.
- Orthorectification: The images would be fully ortho-rectified, making them scale accurate and ready for any uses in GIS. This could be done to all imagery, or by request for customers.
- Mosaicking: The orthorectified images could be used to create tone matched mosaics like the MDOQs created for the Service center base layers.
- APFO could begin by merely scanning imagery, then over time move up through the stages of georeferencing and then orthorectifying.

Standards for scanned products would need to be established.

- Image resolution: Would we go for 1 meter, to match the present base layer pixel size, or choose something else.
- Scanning quality: photogrammetric or flatbed scanners? EROS is creating lower resolution products by using a digital camera mounted above the imagery.
- Image format: This could be uncompressed (Tiff, GeoTiff, IMG, or other) or compressed (MrSID, ECW, JP2, or other)
- Data delivery: Data could be delivered on CD, DVD, hard drive, FTP, or in the future through the Geospatial Data Warehouse (GDW).

Online services could include:

- Website access for browsing the imagery available and ordering. It could include map style searches as well as tabular, and perhaps allow a thumbnail view of the imagery.
- Subscription Service: Customers could have an account, allowing them to easily order, pay, and track the progress of an order.

Appendix 1:
VAULT FILM BY PROGRAM

Program	Count	% of Total
ASCS:	**23477**	**43.000**
Black and White Negative	23411	42.930
Black and White Duped Negative	13	0.024
Black and White Rectified Dupe Negative	2	0.002
Color Infrared Negative	10	0.018
Color Infrared Positive	1	0.002
Natural Color	10	0.018
BIA:	**199**	**0.364**
Color Infrared Negative	2	0.002
Color Infrared Positive	13	0.024
Natural Color Negative	184	0.337
BLM:	**247**	**0.453**
Black and White Negative	29	0.053
Black and White Duped Negative	1	0.002
Color Infrared Positive	14	0.026
Natural Color Negative	203	0.372
Forest Service:	**19675**	**36.080**
Black and White Infrared Negative	625	1.146
Black and White Infrared Positive	1	0.002
Black and White Negative	6169	11.312
Black and White Duped Negative	59	0.108
Black and White Half Tone	4	0.007
Color Infrared Negative Dupe	4	0.007
Color Infrared Negative	948	1.731
Color Infrared Positive	520	0.954
Natural Color Negative	11340	20.795
Color Positive	7	0.013
Unknown	2	0.002
FSA:	**31**	**0.057**
Black and White	1	0.001
Natural Color Negative	30	0.055

GS:	**8**	**0.015**
Black and White:	1	0.001
Black and White Negative Dupe	3	0.005
Natural Color Negative	4	0.007
Military:	**95**	**0.174**
Black and White Negative:	13	0.024
Natural Color Negative	11	0.020
Color Infrared Negative	5	0.009
Color Infrared Positive	2	0.004
Black and White Negative Dupe	64	0.117
NA:	**21**	**0.039**
Black and White Negative	1	0.001
Color Infrared Negative	1	0.001
Natural Color Negative	17	0.031
NA	2	0.002
NAPP1:	**1937**	**3.552**
Black and White Negative Dupe	1	0.001
Color Infrared Positive	1936	3.550
NAPP2:	**1846**	**3.385**
Black and White Negative	1054	1.933
Color Infrared Positive	792	1.452
NAPP3:	**1832**	**3.359**
Black and White Negative	822	1.507
Color Infrared Negative	59	0.108
Color Infrared Positive	951	1.744
NASA:	**513**	**0.941**
Black and White Negative	107	0.196
Black and White Negative Dupe	62	0.114
Black and White Internegative	8	0.015
Color Infrared Negative Dupe	18	0.033
Color Infrared Positive Dupe	88	0.161
Color Infrared Negative	1	0.001
Color Infrared Positive	229	0.420

NFAP:	**587**	**0.941**
Black and White Negative	33	0.061
Black and White Dupe Negative	1	0.001
Black and White Positive	12	0.022
Color Infrared Positive Dupe	5	0.009
Color Infrared Positive	524	0.961
Natural Color Negative	3	0.006
Natural Color Positive	9	0.017
NHAP1:	**1458**	**2.674**
Black and White Internegative	1	0.001
Color Infrared Negative Dupe	1	0.001
Color Infrared Positive	1456	2.670
NHAP2:	**239**	**0.438**
Black and White Internegative	4	0.007
Color Infrared Positive	235	0.431
NPS:	**55**	**0.101**
Natural Color Negative:	55	0.101
NRCS:	**211**	**0.387**
Black and White Negative	90	0.165
Black and White Negative Dupe	3	0.006
Natural Color Negative	113	0.207
Natural Color Positive	5	0.009
OTHER:	**56**	**0.103**
Color Infrared Positive	55	0.101
Natural Color Positive Dupe	1	0.001
PSU:	**15**	**0.027**
Natural Color Positive	15	0.028

SCS:	**2061**	**3.780**
Black and White Infrared Negative	1	0.002
Black and White Negative	1854	3.400
Black and White Negative Dupe	78	0.143
Black and White Internegative	14	0.026
Color Infrared Positive Dupe	3	0.006
Color Infrared Positive	94	0.172
Natural Color Negative	17	0.031

Appendix 2:
Film by Type and Program

BIRN	BW IR Neg	% of Category	% of Total
FS	625	99.84051037	1.146095025
SCS	1	0.159489633	0.001833752
	626		1.147928777
BIRP	**BW IR Pos**		
FS	1		0.001833752
BN	**BW Neg**		
ASCS	23411	69.50184064	**42.92996901**
BLM	29	0.086094288	0.053178809
FS	6169	18.31433321	11.31241634
GS	1	0.002968769	0.001833752
NA	1	0.002968769	0.001833752
MIL	13	0.038593991	0.023838777
NAPP	1876	5.569409809	**3.440118827**
NASA	107	0.317658235	0.196211468
NFAP	33	0.097969362	0.060513817
NRCS	90	0.26718917	0.165037684
SCS	1854	5.504096901	**3.399776282**
Total	33584	99.70312314	**61.58472851**
BNDN	**BW Neg**	**Dupe**	
ASCS	13	4.545454545	0.023838777
BLM	1	0.34965035	0.001833752
FS	59	20.62937063	0.10819137
FSA	1	0.34965035	0.001833752
GS	3	1.048951049	0.005501256
MIL	64	22.37762238	0.117360131
NAPP	1	0.34965035	0.001833752
NASA	62	21.67832168	0.113692626
NFAP	1	0.34965035	0.001833752
NRCS	3	1.048951049	0.005501256
SCS	78	27.27272727	0.143032659
Total	286	100	0.524453083
BNRD	**BW Neg**	**Rectified**	
ASCS	2		0.003667504
BP	**BW Pos**		
NFAP	12		0.022005024
BWHT	**BW Half Tone**		
FS	4		0.007335008

BWIN	**BW Interneg**		
NASA	8	29.62962963	0.014670016
NHAP	5	18.51851852	0.00916876
SCS	14	51.85185185	0.025672529
Total	27	100	0.049511305
CIND	**CIR Neg**	**Dupe**	
FS	4	17.39130435	0.007335008
NASA	18	78.26086957	0.033007537
NHAP	1	4.347826087	0.001833752
Total	23	100	0.042176297
CIPD	**CIR Pos**	**Dupe**	
NASA	88	91.66666667	0.16137018
NFAP	5	5.208333333	0.00916876
SCS	3	3.125	0.005501256
Total	96	100	0.176040196
CIRN	**CIR Neg**		
ASCS	10	0.978473581	0.01833752
BIA	2	0.195694716	0.003667504
FS	944	92.36790607	1.731061926
MIL	5	0.489236791	0.00916876
NAPP	59	5.772994129	0.10819137
NASA	1	0.097847358	0.001833752
NA	1	0.097847358	0.001833752
Total	1022	100	1.874094585
CIRP	**CIR Pos**		
ASCS	1	0.014628438	0.001833752
BIA	13	0.19016969	0.023838777
BLM	14	0.204798128	0.025672529
FS	520	7.606787595	0.953551061
MIL	2	0.029256875	0.003667504
NAPP	3679	**53.81802224**	**6.746373755**
NASA	229	**3.349912229**	0.419929217
NFAP	524	**7.665301346**	0.960886069
NHAP	1691	**24.73668812**	3.1008747
OTHER	55	0.804564073	0.100856362
SCS	94	1.375073142	0.172372692
Total	6822	99.79520187	**12.50985642**
CN	**Natural Color**	**Negative**	
ASCS	10	0.083500334	0.01833752
BIA	184	1.536406146	0.337410375

BLM	203	1.69505678	0.372251664
FS	11340	94.68937876	**20.79474813**
FSA	30	0.250501002	0.055012561
GS	4	0.033400134	0.007335008
MIL	11	0.091850367	0.020171272
NA	17	0.141950568	0.031173785
NFAP	3	0.0250501	0.005501256
NPS	55	0.459251837	0.100856362
NRCS	113	0.943553774	0.207213981
SCS	17	0.141950568	0.031173785
Total	11987	100.0918504	**21.9811857**
CP	**Natural Color**	**Positive**	
FS	7	18.91891892	0.012836264
NFAP	9	24.32432432	0.016503768
NRCS	5	13.51351351	0.00916876
PSU	15	40.54054054	0.027506281
Other	1	2.702702703	0.001833752
Total	37	100	0.067848825
	Unclassified		
	4		0.007335008
	Count		**Percent of Total**
Total	**54533**		**100**

Largest Single Categories by Type and Program

Type: Program	# of Rolls	% of Type	% of Total Rolls
BN:ASCS	23411	69.50184064	42.92996901
CN: FS	11340	94.68937876	20.79474813
CIRP:NAPP	229	53.81802224	6.746373755
BN:NAPP	1876	5.569409809	3.440118827
BN: SCS	1854	5.504096901	3.399776282

Appendix 3:
Vault Holdings By Year
1947 – 2004
(Excluding NDOP & NAIP Film)

Year	# of Rolls	% of Total	Most Film for Year	2nd Largest for year	3rd Largest for Year	Other Film That Year
1947	1	0.001834	ASCS			
1949	1	0.001834	ASCS			
1950	5	0.009169	ASCS	NA		
1951	7	0.012836	ASCS	FS		
1952	1	0.001834	ASCS			
1953	1	0.001834	FS			
1954	203	0.372252	ASCS	FS	SCS	
1955	2100	3.850879	ASCS	FS	NRCS	
1956	1869	3.427283	ASCS	FS	SCS	
1957	1976	3.623494	ASCS	FS	SCS	
1958	2042	3.744522	ASCS	FS	SCS	
1959	1637	3.001852	ASCS	FS		
1960	1705	3.126547	ASCS	FS	SCS	
1961	994	1.82275	ASCS	FS	SCS	
1962	1249	2.290356	ASCS	FS	SCS	
1963	1617	2.965177	ASCS	FS	SCS	
1964	1448	2.655273	ASCS	FS	SCS	
1965	1336	2.449893	ASCS	FS	SCS	
1966	1260	2.310528	ASCS	FS	SCS	
1967	1459	2.675444	ASCS	FS	SCS	
1968	1263	2.316029	ASCS	FS	SCS/MIL	
1969	1477	2.708452	ASCS	FS	SCS	2 others
1970	1488	2.728623	ASCS	FS	SCS	4 others
1971	1476	2.706618	ASCS	FS	SCS	4 others
1972	1216	2.229842	FS	ASCS	SCS	3 others
1973	991	1.817248	FS	ASCS	SCS	2 others
1974	1243	2.279354	FS	ASCS	SCS	3 others
1975	766	1.404654	FS	SCS	ASCS	2 others
1976	859	1.575193	FS	ASCS	SCS	2 others
1977	876	1.606367	FS	ASCS	SCS	3 others
1978	1295	2.374709	ASCS	FS	SCS	3 others
1979	1358	2.490235	FS	ASCS	SCS	4 others
1980	1533	2.811142	FS	ASCS	NHAP1	4 others
1981	1164	2.134487	FS	NHAP1	ASCS	4 others
1982	872	1.599032	FS	NHAP1	ASCS	3 others
1983	999	1.831918	FS	NHAP1	NFAP	4 others
1984	678	1.243284	FS	NHAP1		4 others
1985	730	1.338639	FS	NHAP2	NHAP1	2 others
1986	300	0.550126	FS			3 others
1987	912	1.672382	NAPP1	FS		5 others
1988	1214	2.226175	NAPP1	FS		6 others
1989	1170	2.14549	FS	NAPP1		8 others
1990	746	1.367979	FS	ASCS		6 others
1991	828	1.518347	FS	NAPP1		4 others

1992	401	0.735335	FS			6 others
1993	841	1.542185	FS	NAPP2		5 others
1994	896	1.643042	NAPP2	FS		5 others
1995	805	1.47617	NAPP2	FS		2 others
1996	900	1.650377	NAPP2	FS		3 others
1997	642	1.177269	NAPP3	FS		3 others
1998	655	1.201108	NAPP3	FS		3 others
1999	708	1.298296	NAPP3	FS		3 others
2000	525	0.96272	FS	NAPP3		1 other
2001	732	1.342306	FS	NAPP3		6 others
2002	546	1.001229	FS	NAPP3	BLM	3 others
2003	339	0.621642	FS	NAPP3		3 others
2004	178	0.326408	FS			4 others
	54533					

Appendix 4:
Indexes by Type

Digital		
FS	14	0.642792
NAPP	2141	98.30119
NRCS	22	1.010101
NPS	1	0.045914
Total	2178	100
Line		
BIA	36	0.327332
BLM	82	0.74559
FS	9531	86.66121
FSA	980	8.910711
MIL	4	0.03637
NAPP	52	0.472813
NHAP	6	0.054555
NPS	27	0.245499
NRCS	241	2.191308
OTHER	22	0.200036
PUBLIC	6	0.054555
SCS	11	0.100018
Total	10998	100
Photo		
BIA	20	0.030454
FS	5906	8.993178
FSA	54471	82.94402
GS	2	0.003045
MIL	280	0.426361
NA	2	0.003045
NRCS	4583	6.978621
OTHER	51	0.077659
SCS	357	0.543611
Total	65672	100
Spot		
FS	99	1.969365
FSA	27	0.5371
NAPP	2805	55.79869
NHAP	1953	38.85021
NRCS	141	2.804854
OTHER	2	0.039785
Total	5027	100

Appendix 5:
Indexes by Year

year	PRI	Count	
1950	LI	5	83875
	PI	2191	
1951	PI	1906	
1952	PI	2087	
1953	LI	7	
	PI	1930	
1954	LI	5	
	PI	2275	
1955	LI	18	
	PI	2247	
1956	LI	237	
	PI	2149	
1957	LI	155	
	PI	2170	
1958	LI	215	
	PI	1899	
1959	LI	354	
	PI	1450	
1960	LI	371	
	PI	1690	
1961	LI	91	
	PI	1510	
1962	LI	154	
	PI	1591	
	SI	73	
1963	LI	85	
	PI	2518	
1964	LI	218	
	PI	2492	
1965	LI	213	
	PI	2558	
1966	LI	357	
	PI	2195	
1967	LI	263	
	PI	2364	
1968	LI	143	
	PI	2050	
1969	LI	294	
	PI	2003	
1970	LI	394	
	PI	2219	
1971	LI	82	
	PI	1765	
1972	LI	191	
	PI	1623	
1973	LI	309	
	PI	1863	

1974	LI	149	
	PI	2137	
1975	LI	91	
	PI	846	
1976	LI	411	
	PI	741	
	SI	7	
1977	LI	427	
	PI	1240	
1978	LI	654	
	PI	3913	
	SI	3	
1979	LI	289	
	PI	3004	
	SI	1	
1980	LI	228	
	PI	2792	
	SI	395	
1981	LI	311	
	PI	1314	
	SI	424	
1982	LI	89	
	PI	617	
	SI	279	
1983	LI	151	
	PI	311	
	SI	275	
1984	LI	340	
	PI	6	
	SI	121	
1985	LI	92	
	SI	473	
1986	LI	130	
1987	DI	1	
	LI	268	
	SI	600	
1988	DI	1	
	LI	573	
	SI	475	
1989	DI	6	
	LI	369	
	SI	314	
1990	DI	14	
	LI	609	
	PI	5	
	SI	526	
1991	DI	67	
	LI	225	
	SI	545	
1992	DI	340	
	LI	301	
	SI	260	

1993	DI	526	
	LI	257	
	SI	100	
1994	DI	434	
	LI	158	
	SI	129	
1995	DI	294	
	LI	92	
	SI	3	
1996	DI	284	
	LI	50	
	PI	1	
	SI	2	
1997	DI	16	
	LI	47	
	SI	2	
1998	DI	158	
	LI	84	
	SI	8	
1999	DI	4	
	LI	87	
2000	DI	18	
	LI	56	
2001	LI	149	
2002	LI	58	
	SI	3	
2003	DI	6	
	LI	87	
	SI	9	
2004	DI	9	
	LI	5	

Appendix 6:
Records Appraisal Tool

Records Appraisal Tool

This tool assists the USGS in appraising record collections that are offered to, or sought by, the USGS.

Date:		**Appraiser:**		**Collection Name:**		**Email:**	

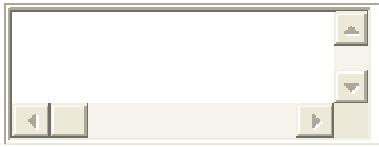
Mission Relevancy

Do the records fit within the scope of our Collecting Policy?	YES☐	NO☐	N/A☐
Does the anticipated current and future utility of the data fit within the EDC mission?	YES☐	NO☐	N/A☐
Are the records significant or unique to the remote sensing, cartographic, and Earth science data user community?	YES☐	NO☐	N/A☐
Would the contribution of the collection complement or supplement EDC's current archive holdings?	YES☐	NO☐	N/A☐

Policy

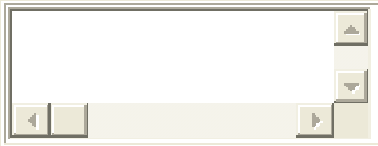
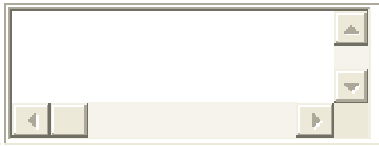
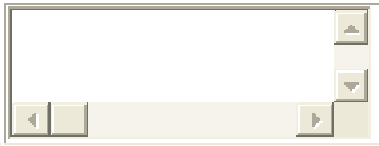
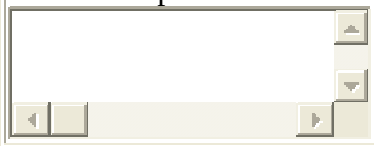
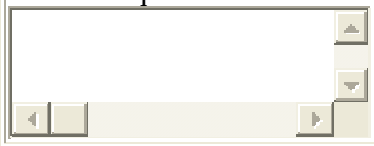
Can the records Authenticity be judged, i.e. are the records considered to be authentic? (ISO 15489-1:2001(E)	YES☐	NO☐	N/A☐
Can the records Reliability be assessed? (ISO 15489-1:2001(E)	YES☐	NO☐	N/A☐
Are the records Integrity of a high nature? (ISO 15489-1:2001(E)	YES☐	NO☐	N/A☐
Are the records Usability conducive to our anticipated exploitation of the information value in the records? (ISO 15489-1:2001(E)	YES☐	NO☐	N/A☐
Do the data involve or reflect any legal rights of the Government or individuals?	YES☐	NO☐	N/A☐
Will the data be needed to defend the agency or the Government against charges of data fraud or misrepresentation?	YES☐	NO☐	N/A☐
Will other users require access to the original "raw" (unedited, unprocessed) data?	YES☐	NO☐	N/A☐
Has the collection been made available to other users, including NARA, through agency schedules or data sharing agreements?	YES☐	NO☐	N/A☐
Do the data support the study of geophysical changes over time?	YES☐	NO☐	N/A☐
Is this collection to be distributed from USGS/EDC?	YES☐	NO☐	N/A☐

General

Who created the record and for what purpose?	

What significant contributions, such as unique or under-recorded spatial or temporal coverage, does the collection bring to EDC as defined through the archive's Collection Policy?			
What is the spatial area covered by the collection?			
What is the temporal range(s) the collection spans?			
How does the record meet the information needs and interest of various user groups served by the archive?			
What is the potential utility of the record based on past and present research use?			
Are there physical, intellectual, or legal barriers in making the records accessible?	YES☐	NO☐	N/A☐
Do the records represent a complete population or universe, or a statistically valid sample?	YES☐	NO☐	N/A☐
Who owns the records?			

Do the records provide information beyond the initial purpose?			
List where the records are also available from other organizations or institutions:			
Do we have similar records already? List the similar records:	YES☐	NO☐	N/A☐
If the collection is not complete, describe what is missing.			
What media are the records stored on?			
Describe the size of the collection in terms of volume, boxes, pallets, tapes, canisters, etc.			
Are the records in a discernable order?	YES☐	NO☐	N/A☐
What physical condition are the records in?	GOOD☐	FAIR☐	POOR☐
Are the records at risk? If yes, describe the risk:	YES☐	NO☐	N/A☐

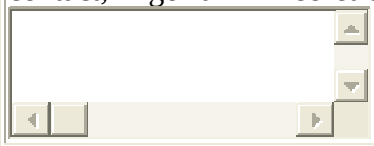
			
Are the records housed on deteriorating media requiring immediate attention?	YES☐	NO☐	N/A☐
What format are the records in?			
Describe any restrictions that apply to the collection:			
Is the anticipated demand for the records high? If so, by what user group(s)? 	YES☐	NO☐	N/A☐
Would acceptance of the records impose unique archiving, distribution, or customer service requirements. Provide details: 	YES☐	NO☐	N/A☐
What is the overall quality of the data?	GOOD☐	FAIR☐	POOR☐
Is this a continuously growing data collection?	YES☐	NO☐	N/A☐
Does this record collection fill gaps in or complement existing collections?	YES☐	NO☐	N/A☐

Are the records of an Intrinsic value?	YES☐	NO☐	N/A☐

Physical

Are the records provided at the level of processing that best preserves the integrity of the records and is the most useful to the anticipated requestors of the data?	YES☐	NO☐	N/A☐
Are the data uncompressed?	YES☐	NO☐	N/A☐
Do the records reside on media that is compatible with USGS systems and have at least 5 years of reliable life remaining?	YES☐	NO☐	N/A☐
Is the format that the records are to be transferred in non-proprietary and computer-compatible?	YES☐	NO☐	N/A☐
If the format is proprietary, has a formal sunset date when the data would be considered Public Domain been agreed upon?	YES☐	NO☐	N/A☐
Can the record's file naming convention be documented?	YES☐	NO☐	N/A☐
Are non-proprietary raw, raster-formatted browse available for each record?	YES☐	NO☐	N/A☐
Are the initial, and any subsequent, processing histories available?	YES☐	NO☐	N/A☐
Are the records at the optimal generation level for long-term preservation?	YES☐	NO☐	N/A☐

Metadata

Is complete metadata, capable of supporting Federal Geographic Data Committee/International Standards Organization collection- and record-level standards with emphasis upon complete frame/image center and corner latitude and longitude coordinates, available?	YES☐	NO☐	N/A☐
Can the metadata be provided via flat, American Standard Code for Information Interchange, delimited files and indexed to tie to the physical inventory of records?	YES☐	NO☐	N/A☐
Is additional information about the records available? Examples include libraries of documentation, guides, Data Information Files, fact sheets, Frequently Asked Questions sheets, instrument documentation, Preliminary Design Reviews, Critical Design Reviews, lessons learned, hardware documentation, firmware documentation, engineering models, computer models, platform documentation, algorithm documentation, URLs, Principle Investigator contact, Algorithm Theoretical Basis Documents. 	YES☐	NO☐	N/A☐
Would training be available from the records provider or creator?	YES☐	NO☐	N/A☐

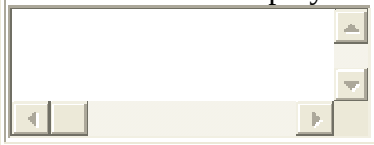
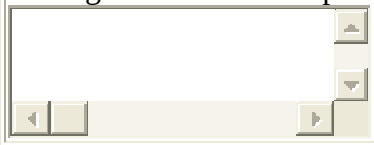
Cost / Benefit

Are there sufficient funds to acquire, maintain, and make records available now and in the future?	YES☐	NO☐	N/A☐
Is there a potential of cost sharing for capital investment and/or recurring costs?	YES☐	NO☐	N/A☐
Would the data be difficult or expensive to replicate by us or someone else?	YES☐	NO☐	N/A☐
Are there significant costs or consequences to the program or the Government if the data are not obtained or maintained?	YES☐	NO☐	N/A☐

Does the estimated research value of the data exceed the costs to maintain them for secondary use by Government researchers or other?	YES☐	NO☐	N/A☐
Estimate the cost of preserving the record weighed against the benefit of retaining the information, i.e. what are the costs of identifying, appraising, and accessioning the records?			
What are the costs of processing the collection to an accessible level?			
Are the resources necessary for any preservation or access functions available?	YES☐	NO☐	N/A☐
What are the annual costs of housing the original records or reducing their bulk by sampling?			
Will special equipment be required to read or process the records?	YES☐	NO☐	N/A☐
Estimate the cost to deaccession/purge the collection.	N/A☐		

Photographs

Are the records paper photographs?	YES☐	NO☐	N/A☐

Are the frames on a polyester base? If not, what is the base? 	YES ☐	NO ☐	N/A ☐
What generation are the photographs? 			
Rate the overall quality of the photographs based upon proper exposure, color balance and sharpness.	GOOD ☐	FAIR ☐	POOR ☐
Do the frames contain clouds or haze?	YES ☐	NO ☐	N/A ☐
Are the frames in roll format or single-cut format?	ROLL ☐	SINGLE ☐	
Are the frames free from gross scratches, tears, pinholes or dirt?	YES ☐	NO ☐	N/A ☐
Are the photographic rolls stored on reels securely enclosed in non-metal containers?	YES ☐	NO ☐	N/A ☐
Is the film type, camera type, camera focal length, lens number, date taken, flying height, and area of coverage available electronically?	YES ☐	NO ☐	N/A ☐
Is the manufacturer number of the film available?	YES ☐	NO ☐	N/A ☐
Is the film titled with roll and frame reference numbers?	YES ☐	NO ☐	N/A ☐

Additional Comments:

Send Clear Form

Appendix 7:
Work Orders by Year
1954 – 2004

YEAR	CUSTOMER TYPE	# OF WORK ORDERS	% WORK ORDERS FOR YEAR	% WORK ORDERS / TOTAL	NUMBER OF UNITS	% OF UNITS FOR YEAR	% UNITS / TOTAL
1954	APFO	3	18.75	0.01809	76	**68.46847**	0.009246
	Other Fed	0	0	0	0	0	0
	Public	12	**75**	0.072359	33	29.72973	0.004015
	State	1	6.25	0.00603	2	1.801802	0.000243
	Total	***16***	***100***	***0.096479***	***111***	***100***	***0.013503***
1955	APFO	2	0.619195	0.01206	60	1.73913	0.007299
	Other Fed	25	7.739938	0.150748	559	16.2029	0.068003
	Public	242	**74.9226**	1.459238	1529	**44.31884**	0.186005
	State	54	16.71827	0.325615	1302	37.73913	0.15839
	Total	***323***	***100***	***1.94766***	***3450***	***100***	***0.419698***
1956	APFO	6	1.734104	0.036179	106	2.955116	0.012895
	Other Fed	30	8.67052	0.180897	273	7.610817	0.033211
	Public	284	**82.08092**	1.712494	2770	**77.22331**	0.336975
	State	26	7.514451	0.156778	438	12.21076	0.053283
	Total	***346***	***100***	***2.086348***	***3587***	***100***	***0.436365***
1957	APFO	6	1.643836	0.036179	160	5.845817	0.019464
	Other Fed	31	8.493151	0.186927	257	9.389843	0.031264
	Public	299	**81.91781**	1.802943	1419	**51.84509**	0.172624
	State	29	7.945205	0.174867	901	32.91925	0.109608
	Total	***365***	***100***	***2.200917***	***2737***	***100***	***0.332961***
1958	APFO	11	2.380952	0.066329	1071	16.53033	0.130289
	Other Fed	21	4.545455	0.126628	371	5.726192	0.045133
	Public	379	**82.03463**	2.285335	2118	32.69023	0.257658
	State	51	11.03896	0.307525	2919	**45.05325**	**0.355101**
	Total	***462***	***100***	***2.785818***	***6479***	***100***	***0.788181***
1959	APFO	1	0.3861	0.00603	68	3.018198	0.008272
	Other Fed	20	7.722008	0.120598	202	8.965823	0.024574
	Public	215	**83.01158**	1.29643	1159	**51.44252**	0.140994
	State	23	8.880309	0.138688	824	36.57346	0.100241
	Total	***259***	***100***	***1.561746***	***2253***	***100***	***0.274081***

1960	APFO	2	0.884956	0.01206	17	0.788132	0.002068
	Other Fed	16	7.079646	0.096479	426	19.74965	0.051824
	Public	188	83.18584	1.133623	1213	**56.23551**	0.147563
	State	20	8.849558	0.120598	501	23.2267	0.060947
	Total	***226***	***100***	***1.362759***	***2157***	***100***	***0.262403***
1961	APFO	0	0	0	0	0	0
	Other Fed	6	4.411765	0.036179	33	1.873935	0.004015
	Public	114	**83.82353**	0.68741	828	**47.01874**	0.100728
	State	16	11.76471	0.096479	900	**51.10733**	0.109487
	Total	***136***	***100***	***0.820068***	***1761***	***100***	***0.214229***
1962	APFO	0	0	0	0	0	0
	Other Fed	19	11.80124	0.114568	825	**43.6739**	0.100363
	Public	123	**76.39752**	0.741679	653	34.56855	0.079439
	State	19	11.80124	0.114568	411	21.75754	0.049999
	Total	***161***	***100***	***0.970815***	***1889***	***100***	***0.2298***
1963	APFO	1	0.456621	0.00603	78	3.091558	0.009489
	Other Fed	23	10.50228	0.138688	586	23.22632	0.071288
	Public	171	**78.08219**	1.031114	1141	**45.22394**	0.138805
	State	24	10.9589	0.144718	718	28.45818	0.087346
	Total	***219***	***100***	***1.32055***	***2523***	***100***	***0.306927***
1964	APFO	4	2.739726	0.02412	832	22.88858	0.101214
	Other Fed	13	8.90411	0.078389	646	17.77166	0.078587
	Public	103	**70.54795**	0.621081	1561	**42.9436**	0.189898
	State	26	17.80822	0.156778	596	16.39615	0.072504
	Total	***146***	***100***	***0.880367***	***3635***	***100***	*0.442204*
1965	APFO	5	2.906977	0.03015	476	14.92163	0.057906
	Other Fed	14	8.139535	0.084419	906	**28.40125**	0.110216
	Public	128	**74.4186**	0.771828	984	**30.84639**	0.119705
	State	25	14.53488	0.150748	824	**25.83072**	0.100241
	Total	***172***	***100***	***1.037144***	***3190***	***100***	***0.388069***
1966	APFO	1	0.609756	0.00603	378	10.18045	0.045984
	Other Fed	22	13.41463	0.132658	313	8.429841	0.038077
	Public	123	**75**	0.741679	2009	**54.10719**	0.244398
	State	18	10.97561	0.108538	1013	27.28252	0.123233
	Total	***164***	***100***	***0.988905***	***3713***	***100***	***0.451693***

1967	APFO	1	0.793651	0.00603	2	0.069614	0.000243
	Other Fed	13	10.31746	0.078389	415	14.44483	0.050485
	Public	87	**69.04762**	0.524602	1349	**46.9544**	0.164108
	State	25	19.84127	0.150748	1107	38.53115	0.134668
	Total	***126***	***100***	***0.759768***	***2873***	***100***	***0.349505***
1968	APFO	1	1.219512	0.00603	58	2.455546	0.007056
	Other Fed	10	12.19512	0.060299	574	24.30144	0.069828
	Public	54	**65.85366**	0.325615	1321	**55.92718**	0.160702
	State	17	20.73171	0.102508	409	17.31583	0.049756
	Total	***82***	***100***	***0.494452***	***2362***	*100*	***0.287341***
1969	APFO	3	2.586207	0.01809	81	4.475138	0.009854
	Other Fed	10	8.62069	0.060299	262	14.47514	0.031873
	Public	85	**73.27586**	0.512542	1144	**63.20442**	0.13917
	State	18	15.51724	0.108538	323	17.8453	0.039293
	Total	***116***	***100***	***0.699469***	***1810***	***100***	***0.22019***
1970	APFO	1	0.689655	0.00603	2	0.073992	0.000243
	Other Fed	27	18.62069	0.162808	1130	**41.8054**	0.137466
	Public	99	**68.27586**	0.596961	990	**36.62597**	0.120435
	State	18	12.41379	0.108538	581	21.49464	0.07068
	Total	***145***	***100***	***0.874337***	***2703***	***100***	***0.328825***
1971	APFO	5	3.90625	0.03015	651	22.16547	0.079195
	Other Fed	20	15.625	0.120598	953	**32.44808**	0.115934
	Public	82	**64.0625**	0.494452	1026	**34.93361**	0.124815
	State	21	16.40625	0.126628	307	10.45284	0.037347
	Total	***128***	***100***	***0.771828***	***2937***	***100***	***0.357291***
1972	APFO	1	0.952381	0.00603	3	0.101351	0.000365
	Other Fed	22	20.95238	0.132658	1346	**45.47297**	0.163743
	Public	63	**60**	0.379884	817	27.60135	0.099389
	State	19	18.09524	0.114568	794	26.82432	0.096591
	Total	***105***	***100***	***0.63314***	***2960***	***100***	***0.360089***
1973	APFO	0	0	0	0	0	0
	Other Fed	13	18.84058	0.078389	539	**53.26087**	0.06557
	Public	36	**52.17391**	0.217077	357	35.27668	0.04343
	State	20	28.98551	0.120598	116	11.46245	0.014112
	Total	***69***	***100***	***0.416064***	***1012***	***100***	***0.123112***

1974	APFO	0	0	0	0	0	0
	Other Fed	37	14.97976	0.223107	2475	**69.54201**	0.301088
	Public	181	**73.27935**	1.091413	797	22.39393	0.096956
	State	29	11.74089	0.174867	287	8.064063	0.034914
	Total	***247***	***100***	***1.489387***	***3559***	***100***	***0.432958***
1975	APFO	0	0	0	0	0	0
	Other Fed	13	16.4557	0.078389	989	**56.64376**	0.120314
	Public	42	**53.16456**	0.253256	302	17.29668	0.036739
	State	24	30.37975	0.144718	455	26.05956	0.055352
	Total	***79***	***100***	***0.476363***	***1746***	***100***	***0.212404***
1976	APFO	0	0	0	0	0	0
	Other Fed	26	34.66667	0.156778	1973	**85.33737**	0.240019
	Public	38	**50.66667**	0.229137	227	9.818339	0.027615
	State	11	14.66667	0.066329	112	4.844291	0.013625
	Total	***75***	***100***	***0.452243***	***2312***	***100***	***0.281259***
1977	APFO	7	5.30303	0.042209	323	25.31348	0.039293
	Other Fed	17	12.87879	0.102508	536	**42.00627**	0.065205
	Public	92	**69.69697**	0.554752	352	27.58621	0.042821
	State	16	12.12121	0.096479	65	5.094044	0.007907
	Total	***132***	***100***	***0.795948***	***1276***	***100***	***0.155228***
1978	APFO	3	1.298701	0.01809	3	0.085421	0.000365
	Other Fed	31	13.41991	0.186927	1635	**46.55467**	0.198901
	Public	170	**73.59307**	1.025084	1058	30.12528	0.128707
	State	27	11.68831	0.162808	816	23.23462	0.099268
	Total	***231***	***100***	***1.392909***	***3512***	***100***	***0.427241***
1979	APFO	1		0.00603	1	0.035727	0.000122
	Other Fed	28	15.64246	0.168837	814	29.08181	0.099024
	Public	135	**75.41899**	0.814038	1771	**63.2726**	0.215445
	State	15	8.379888	0.090449	213	7.609861	0.025912
	Total	***179***	***100***	***1.079354***	***2799***	***100***	***0.340503***
1980	APFO	6	2.307692	0.036179	30	1.117318	0.00365
	Other Fed	26	10	0.156778	254	9.459963	0.0309
	Public	202	**77.69231**	1.218041	1351	**50.31657**	0.164351
	State	26	10	0.156778	1050	39.10615	0.127734
	Total	***260***	***100***	***1.567776***	***2685***	***100***	***0.326635***

1981	APFO	4	2.919708	0.02412	4	0.160966	0.000487
	Other Fed	39	28.46715	0.235166	1415	**56.94165**	0.172137
	Public	69	**50.36496**	0.416064	606	24.38632	0.073721
	State	25	18.24818	0.150748	460	18.51107	0.05596
	Total	***137***	***100***	***0.826097***	***2485***	***100***	***0.302304***
1982	APFO	0	0	0	0	0	0
	Other Fed	16	26.22951	0.096479	378	**40.64516**	0.045984
	Public	34	**55.7377**	0.205017	337	**36.23656**	0.040997
	State	11	18.03279	0.066329	215	23.11828	0.026155
	Total	***61***	***100***	***0.367824***	***930***	***100***	***0.113136***
1983	APFO	2	1.754386	0.01206	6	0.293686	0.00073
	Other Fed	30	26.31579	0.180897	1405	**68.77141**	0.170921
	Public	62	**54.38596**	0.373854	491	24.03328	0.059731
	State	20	17.54386	0.120598	141	6.901615	0.017153
	Total	***114***	***100***	***0.68741***	***2043***	***100***	***0.248534***
1984	APFO	1	1.886792	0.00603	1	0.060938	0.000122
	Other Fed	13	24.5283	0.078389	333	20.2925	0.04051
	Public	24	**45.28302**	0.144718	309	18.82998	0.03759
	State	15	28.30189	0.090449	998	**60.81658**	0.121408
	Total	***53***	***100***	***0.319585***	***1641***	***100***	***0.19963***
1985	APFO	4	3.960396	0.02412	47	3.939648	0.005718
	Other Fed	11	10.89109	0.066329	32	2.682313	0.003893
	Public	72	**71.28713**	0.434153	839	**70.32691**	0.102066
	State	14	13.86139	0.084419	275	23.05113	0.033454
	Total	***101***	***100***	***0.609021***	***1193***	***100***	***0.14513***
1986	APFO	0	0	0	0	0	0
	Other Fed	1	16.66667	0.00603	132	**66**	0.016058
	Public	4	**66.66667**	0.02412	67	33.5	0.008151
	State	1	16.66667	0.00603	1	0.5	0.000122
	Total	***6***	***100***	*0.036179*	***200***	***100***	***0.02433***
1987	APFO	11	4.661017	0.066329	19	1.078932	0.002311
	Other Fed	47	19.91525	0.283406	656	**37.25156**	0.079804
	Public	154	**65.25424**	0.928606	825	**46.84838**	0.100363
	State	24	10.16949	0.144718	261	14.82112	0.031751
	Total	***236***	***100***	***1.423058***	***1761***	***100***	***0.214229***

1988	APFO	9	2.866242	0.054269	44	2.132816	0.005353
	Other Fed	113	35.98726	0.68138	966	**46.82501**	0.117516
	Public	178	**56.6879**	1.073324	627	30.39263	0.076276
	State	14	4.458599	0.084419	426	20.64954	0.051824
	Total	***314***	***100***	***1.893391***	***2063***	***100***	***0.250967***
1989	APFO	2	0.598802	0.01206	2	0.098232	0.000243
	Other Fed	95	28.44311	0.572841	1130	**55.50098**	0.137466
	Public	226	**67.66467**	1.362759	776	38.11395	0.094402
	State	11	3.293413	0.066329	128	6.286837	0.015571
	Total	***334***	***100***	***2.013989***	***2036***	***100***	***0.247683***
1990	APFO	1	0.154321	0.00603	247	5.796761	0.030048
	Other Fed	164	25.30864	0.988905	2283	**53.57897**	0.277731
	Public	452	**69.75309**	2.725519	1461	34.28773	0.177733
	State	31	4.783951	0.186927	270	6.336541	0.032846
	Total	***648***	***100***	***3.907381***	***4261***	***100***	***0.518358***
1991	APFO	4	0.671141	0.02412	19	0.262105	0.002311
	Other Fed	284	**47.65101**	1.712494	5652	**77.96938**	0.687575
	Public	291	**48.8255**	1.754703	1194	16.47124	0.145252
	State	17	2.852349	0.102508	384	5.297282	0.046714
	Total	***596***	***100***	***3.593825***	***7249***	***100***	***0.881853***
1992	APFO	6	0.674916	0.036179	91	2.125175	0.01107
	Other Fed	237	26.65917	1.429088	1805	42.1532	0.219581
	Public	620	**69.74128**	3.738543	2161	**50.46707**	0.262889
	State	26	2.924634	0.156778	225	5.254554	0.027372
	Total	***889***	***100***	***5.360589***	***4282***	***100***	***0.520913***
1993	APFO	5	0.778816	0.03015	15	0.132485	0.001825
	Other Fed	265	41.27726	1.597926	8862	**78.27239**	1.078077
	Public	350	**54.51713**	2.110468	1953	17.2496	0.237586
	State	22	3.426791	0.132658	492	4.345522	0.059853
	Total	***642***	***100***	***3.871201***	***11322***	***100***	***1.37734***
1994	APFO	37	3.760163	0.223107	249	2.453202	0.030291
	Other Fed	203	20.63008	1.224071	4580	**45.12315**	0.557165
	Public	722	**73.37398**	4.353594	4520	**44.53202**	0.549866
	State	22	2.235772	0.132658	801	7.891626	0.097443
	Total	***984***	***100***	***5.93343***	***10150***	***100***	***1.234765***

1995	APFO	36	2.769231	0.217077	316	2.764654	0.038442
	Other Fed	253	19.46154	1.525567	6676	**58.4077**	0.812147
	Public	982	**75.53846**	5.92137	3383	29.59755	0.411548
	State	29	2.230769	0.174867	1055	9.230096	0.128343
	Total	***1300***	***100***	***7.838881***	***11430***	***100***	***1.390479***
1996	APFO	26	2.716823	0.156778	474	2.333826	0.057663
	Other Fed	269	28.10867	1.622045	13423	**66.0906**	1.632931
	Public	632	**66.03971**	3.810902	2549	12.55047	0.31009
	State	30	3.134796	0.180897	3864	19.02511	0.470062
	Total	***957***	***100***	***5.770622***	***20310***	***100***	***2.470746***
1997	APFO	95	9.396637	0.572841	5541	15.75311	0.674072
	Other Fed	126	12.46291	0.759768	17654	**50.19048**	2.147639
	Public	745	**73.68942**	4.492282	2798	7.954739	0.340381
	State	45	4.451039	0.271346	9181	26.10167	1.116884
	Total	***1011***	***100***	***6.096237***	***35174***	***100***	***4.278977***
1998	APFO	63	6.666667	0.379884	5320	14.43769	0.647187
	Other Fed	219	23.1746	1.32055	23909	**64.88548**	2.90857
	Public	612	**64.7619**	3.690304	3691	10.01683	0.449016
	State	51	5.396825	0.307525	3928	10.66001	0.477848
	Total	***945***	***100***	***5.698263***	***36848***	***100***	***4.482621***
1999	APFO	67	13.16306	0.404004	11351	40.44251	1.380868
	Other Fed	96	18.86051	0.578871	13435	**47.8676**	1.63439
	Public	314	**61.68959**	1.893391	2301	8.19824	0.279921
	State	32	6.286837	0.192957	980	3.491645	0.119219
	Total	***509***	***100***	***3.069223***	***28067***	***100***	***3.414398***
2000	APFO	92	18.29026	0.554752	16435	28.48354	1.999346
	Other Fed	130	25.84493	0.783888	35524	**61.56672**	4.321555
	Public	340	**67.59443**	2.050169	2549	4.417678	0.31009
	State	31	6.163022	0.186927	3192	5.532062	0.388312
	Total	***593***	***117.8926***	***3.575736***	***57700***	***100***	***7.019302***
2001	APFO	296	**39.67828**	1.784853	141459	**62.67595**	17.20873
	Other Fed	233	31.23324	1.404969	72342	32.05242	8.800527
	Public	190	25.46917	1.145683	10726	4.752347	1.304836
	State	27	3.619303	0.162808	1172	0.519276	0.142576
	Total	***746***	***100***	***4.498312***	***225699***	***100***	***27.45666***

2002	APFO	121	**44.64945**	0.729619	101748	**66.98972**	12.37782
	Other Fed	69	25.46125	0.416064	49024	32.27684	5.963852
	Public	72	26.56827	0.434153	861	0.566873	0.104742
	State	9	3.321033	0.054269	253	0.166572	0.030778
	Total	***271***	***100***	***1.634105***	***151886***	***100***	***18.47719***
2003	APFO	44	**43.13725**	0.265316	85173	**72.33253**	10.36144
	Other Fed	36	35.29412	0.217077	26271	22.31045	3.195912
	Public	11	10.78431	0.066329	131	0.111251	0.015936
	State	11	10.78431	0.066329	6177	5.245771	0.751442
	Total	**102**	**100**	**0.615051**	**117752**	**100**	**14.32473**
2004	APFO	14	24.13793	0.084419	9188	**69.59024**	1.117736
	Other Fed	10	17.24138	0.060299	2345	17.76111	0.285273
	Public	24	**41.37931**	0.144718	1618	12.25479	0.196832
	State	10	17.24138	0.060299	52	0.39385	0.006326
	Total	**58**	**100**	**0.349735**	**13203**	**100**	**1.606167**
Unclass	APFO	2	25	0.01206	159	**52.47525**	0.019343
	Public	2	25	0.01206	2	0.660066	0.000243
	APFO Partner	4	**50**	0.02412	142	**46.86469**	0.017275
	Total	**8**	**100**	**0.048239**	**303**	**100**	**0.03686**
		33168		200	1644038		200

Appendix 8:
Work Orders by Customers

Customer	# Work Orders	% WOs	# Unit	% Units
APFO Sales	2	0.01206054	381	0.046349
APFO BW	8	0.04824218	290	0.035279
APFO Color	42	0.25327142	206	0.02506
APFO GSB	175	**1.05529759**	9322	**1.134037**
APFO Director	453	**2.7317132**	54370	**6.614202**
APFO Service Center Support	91	0.54875475	2893	0.351938
APFO Inspection	1	0.00603027	1	0.000122
APFO Contracting	29	0.17487789	539	0.06557
APFO Contracting Obligations	148	0.89248025	307197	**37.37103**
APFO Partnership Order	67	0.40402822	7327	0.891342
US Air Force	2	0.01206054	11	0.001338
US Army	66	0.39799795	2165	0.263376
US Navy	2	0.01206054	4	0.000487
US Department of Agriculture	2	0.01206054	2	0.000243
Forest Service	499	**3.00910571**	202604	**24.64712**
NRCS	343	**2.06838328**	33080	**4.024238**
National Agri. Statistical Service	540	**3.25634686**	9622	**1.170533**
Farm Service Agency	1340	**8.08056443**	14681	**1.785968**
NOAA	7	0.0422119	61	0.007421
Dept of the Interior	1	0.00603027	4	0.000487
US Geological Survey	85	0.51257312	12154	**1.478555**
Fish and Wildlife Service	43	0.25930169	1016	0.123598
National Park Service	57	0.3437255	2158	0.262524
Bureau of Indian Affairs	15	0.09045408	4696	0.571276
Bureau of Reclamation	34	0.20502925	1183	0.143914
Bureau of Land Management	212	**1.27841766**	23764	**2.890931**
Department of Justice	16	0.09648435	72	0.008759
Department of Transportation	4	0.02412109	41	0.004988
Environmental Protection Agency	223	1.34475065	2204	0.26812
Tennessee Valley Authority	1	0.00603027	2	0.000243
Public Non-Federal	10928	**65.898812**	77053	**9.373628**
Alabama	20	0.12060544	2602	0.316538
Alaska	10	0.06030272	154	0.018734
Arizona	24	0.14472653	1711	0.208146
Arkansas	18	0.1085449	302	0.036739
California	53	0.31960441	2637	0.320796
Colorado	68	0.41005849	4557	0.554367
Connecticut	2	0.01206054	2	0.000243
Delaware	10	0.06030272	17	0.002068
Florida	24	0.14472653	1653	0.20109
Georgia	13	0.07839354	52	0.006326
Idaho	25	0.1507568	301	0.036617
Illinois	13	0.07839354	1591	0.193548
Indiana	14	0.08442381	258	0.031386

Iowa	30	0.18090816	3536	0.43016
Kansas	6	0.03618163	86	0.010462
Kentucky	12	0.07236326	152	0.018491
Louisiana	11	0.06633299	118	0.014355
Maine	14	0.08442381	5397	0.656554
Maryland	12	0.07236326	594	0.072261
Massachusetts	12	0.07236326	175	0.021289
Michigan	38	0.22915033	939	0.114231
Minnesota	8	0.04824218	10	0.001217
Mississippi	27	0.16281734	459	0.055838
Missouri	21	0.12663571	116	0.014112
Montana	80	0.48242176	3649	0.443907
Nebraska	46	0.27739251	6600	0.802901
Nevada	5	0.03015136	292	0.035522
New Hampshire	19	0.11457517	198	0.024087
New Jersey	145	0.87438943	2161	0.262889
New York	17	0.10251462	76	0.009246
North Carolina	30	0.18090816	2865	0.348532
North Dakota	13	0.07839354	147	0.017883
Ohio	14	0.08442381	1028	0.125058
Oklahoma	11	0.06633299	185	0.022506
Oregon	33	0.19899897	1377	0.167514
Pennsylvania	18	0.1085449	268	0.032603
South Carolina	12	0.07236326	154	0.018734
South Dakota	8	0.04824218	26	0.003163
Tennessee	9	0.05427245	61	0.007421
Texas	42	0.25327142	792	0.096348
Utah	102	0.61508774	3461	0.421036
Virginia	9	0.05427245	30	0.00365
Washington	28	0.16884762	538	0.065449
West Virginia	8	0.04824218	10	0.001217
Wisconsin	6	0.03618163	1557	0.189412
Wyoming	7	0.0422119	22	0.002676
	16583	**100**	**822019**	**100**
Summary:	**Work Orders**	**% WO**	**Units**	**% Units**
APFO	**1016**	**6.12675632**	**382526**	**46.53493**
Federal	**3492**	**21.0577097**	**309524**	**37.65412**
Public	**10928**	**65.898812**	**77053**	**9.373628**
States	**1147**	**6.91672194**	**52916**	**6.437321**
Total	**16583**	**100**	**822019**	**100**

Largest Customers	
by Work Order	
Public Non-Federal	65.89
FSA	8.08
NASS	3.25
Forest Service	3.01
APFO Director	2.73
NRCS	2.07
EPA	1.34
BLM	1.28
APFO GSB	1.06
Largest Customers	
by Units	
APFO Contract Oblig.	37.37
Forest Service	24.65
Public Non-Federal	9.37
APFO Director	6.61
NRCS	4.02
BLM	2.89
FSA	1.79
NASS	1.17
APFO GSB	1.13

Appendix 9
Work Orders by Customer
1993 - Present

Customer	# WorkOrders	% WO	# Units	% Units
APFO Sales	2	0.0246124	381	0.05292813
APFO BW	5	0.0615309	38	0.00527892
APFO Color	26	0.3199606	142	0.0197265
APFO GSB	149	**1.8336205**	6281	0.87255016
APFO Director	406	**4.9963081**	53725	**7.46342263**
APFO Service Center Support	90	**1.107556**	2503	0.34771423
APFO Inspection	1	0.0123062	1	0.00013892
APFO Contracting	28	0.344573	527	0.07321031
APFO Contracting Obligations	148	**1.8213143**	307197	**42.6754964**
APFO Partnership Order	47	0.5783904	6775	0.94117614
US Air Force	1	0.0123062	8	0.00111135
US Army	11	0.135368	658	0.09140869
US Department of Agriculture	2	0.0246124	2	0.00027784
Forest Service	372	**4.5778981**	196598	**27.3111952**
NRCS	132	**1.6244155**	15634	**2.17185946**
National Agri. Statistical Service	452	**5.5623923**	9262	**1.28666767**
Farm Service Agency	634	**7.8021167**	11242	**1.56172726**
NOAA	2	0.0246124	12	0.00166703
US Geological Survery	55	0.6768398	11303	**1.57020132**
Fish and Wildlife Service	14	0.1722865	838	0.11641411
National Park Service	18	0.2215112	1669	0.23185579
Bureau of Indian Affairs	5	0.0615309	2022	0.28089419
Bureau of Reclamation	9	0.1107556	814	0.11308006
Bureau of Land Management	168	**2.0674379**	23364	**3.24570324**
Department of Justice	5	0.0615309	33	0.00458433
Department of Transportation	2	0.0246124	39	0.00541784
Environmental Protection Agency	26	0.3199606	545	0.07571085
Tennessee Valley Authority	1	0.0123062	2	0.00027784
Public Non-Federal	4995	**61.469358**	37081	**5.15125499**
Alabama	5	0.0615309	2520	0.35007585
Alaska	3	0.0369185	52	0.00722379
Arizona	11	0.135368	603	0.08376815
Arkansas	7	0.0861432	205	0.02847839
California	13	0.1599803	1088	0.15114386
Colorado	22	0.2707359	3641	0.50580404
Connecticut	1	0.0123062	1	0.00013892
Delaware	3	0.0369185	5	0.00069459
Georgia	2	0.0246124	12	0.00166703
Idaho	4	0.0492247	48	0.00666811
Illinois	2	0.0246124	97	0.01347514
Indiana	4	0.0492247	147	0.02042109
Iowa	4	0.0492247	234	0.03250704

Kansas	2	0.0246124	32	0.00444541
Kentucky	1	0.0123062	2	0.00027784
Louisiana	2	0.0246124	4	0.00055568
Maine	3	0.0369185	5383	0.74780091
Maryland	7	0.0861432	23	0.00319514
Massachusetts	1	0.0123062	9	0.00125027
Michigan	7	0.0861432	302	0.04195353
Minnesota	3	0.0369185	4	0.00055568
Mississippi	13	0.1599803	162	0.02250488
Missouri	4	0.0492247	82	0.01139136
Montana	22	0.2707359	2597	0.36077261
Nebraska	19	0.2338174	6177	0.85810259
Nevada	4	0.0492247	201	0.02792272
New Hampshire	7	0.0861432	79	0.0109746
New Jersey	21	0.2584297	667	0.09265896
New York	4	0.0492247	29	0.00402865
North Carolina	25	0.3076544	2781	0.38633371
North Dakota	2	0.0246124	41	0.00569568
Ohio	5	0.0615309	518	0.07196004
Oklahoma	4	0.0492247	70	0.00972433
Oregon	14	0.1722865	486	0.06751463
Pennsylvania	1	0.0123062	3	0.00041676
South Carolina	1	0.0123062	1	0.00013892
South Dakota	1	0.0123062	2	0.00027784
Tennessee	3	0.0369185	9	0.00125027
Texas	7	0.0861432	118	0.01639244
Utah	33	0.4061039	838	0.11641411
Virginia	2	0.0246124	5	0.00069459
Washington	11	0.135368	381	0.05292813
West Virginia	4	0.0492247	6	0.00083351
Wisconsin	3	0.0369185	1473	0.20462767
Wyoming	3	0.0369185	10	0.00138919
	8126	100	719844	100
Summation				
Customer	**# WorkOrders**	**% WO**	**# Units**	**% Units**
APFO	902	11.100172	377570	52.4516423
Other Federal	1909	23.492493	274045	38.0700541
Public Non-Federal	4995	61.469358	37081	5.15125499
States	320	3.9379769	31148	4.32704864
	8126	100	719844	100

Main Customers				
By Work Orders				
Public Non-Federal	4995	61.47		
FSA	634	7.8		
NASS	452	5.56		
APFO Director	406	5		
Forest Service	372	4.58		
BLM	168	2.07		
APFO GSB	149	1.83		
APFO Contr. Oblig	148	1.82		
NRCS	132	1.62		
APFO SC Support	90	1.12		
Main Customers				
by Units				
APFO Contr. Oblig	307197	42.68		69.99
Forest Service	196598	27.31		For both
APFO Director	53725	7.46		
Public	37081	5.15		
BLM	23364	3.25		
NRCS	15634	2.17		
USGS	11303	1.57		
FSA	11242	1.56		
NASS	9262	1.29		

Appendix 10
Work Orders by Customer
1954-1992

APFO BW	3	0.0354736	252	0.246636
APFO Color	16	0.1891924	64	0.062638
APFO GSB	26	0.3074376	3041	**2.976266**
APFO Director	47	0.5557526	645	0.63127
APFO Service Center Support	1	0.0118245	390	0.381698
APFO Contracting	1	0.0118245	12	0.011745
APFO Partnership Order	20	0.2364905	552	0.54025
US Air Force	1	0.0118245	3	0.002936
US Army	55	0.6503488	1507	**1.47492**
US Navy	2	0.023649	4	0.003915
Forest Service	127	**1.5017146**	6006	**5.87815**
NRCS	211	**2.4949746**	17446	**17.07463**
National Agri. Statistical Service	88	**1.0405581**	360	0.352337
Farm Service Agency	706	**8.348114**	3439	**3.365794**
NOAA	5	0.0591226	49	0.047957
Dept of the Interior	1	0.0118245	4	0.003915
US Geological Survey	30	0.3547357	851	0.832885
Fish and Wildlife Service	29	0.3429112	178	0.174211
National Park Service	39	0.4611564	489	0.478591
Bureau of Indian Affairs	10	0.1182452	2674	**2.617079**
Bureau of Reclamation	25	0.2956131	369	0.361145
Bureau of Land Management	44	0.5202791	400	0.391485
Department of Justice	11	0.1300698	39	0.03817
Department of Transportation	2	0.023649	2	0.001957
Environmental Protection Agency	197	**2.3294312**	1659	**1.623685**
Public Non-Federal	5933	**70.154901**	39972	**39.12112**
Alabama	15	0.1773679	82	0.080254
Alaska	7	0.0827717	102	0.099829
Arizona	13	0.1537188	1108	**1.084414**
Arkansas	11	0.1300698	97	0.094935
California	40	0.472981	1549	**1.516026**
Colorado	46	0.5439281	916	0.896501
Connecticut	1	0.0118245	1	0.000979
Delaware	7	0.0827717	12	0.011745
Florida	24	0.2837886	1653	**1.617813**
Georgia	11	0.1300698	40	0.039149
Idaho	21	0.248315	253	0.247614
Illinois	11	0.1300698	1494	**1.462197**
Indiana	10	0.1182452	111	0.108637
Iowa	26	0.3074376	3302	**3.23171**
Kansas	4	0.0472981	54	0.052851
Kentucky	11	0.1300698	150	0.146807
Louisiana	9	0.1064207	114	0.111573
Maine	11	0.1300698	14	0.013702

Maryland	5	0.0591226	571	0.558845
Massachusetts	11	0.1300698	166	0.162466
Michigan	31	0.3665602	637	0.62344
Minnesota	5	0.0591226	6	0.005872
Mississippi	14	0.1655433	297	0.290678
Missouri	17	0.2010169	34	0.033276
Montana	58	0.6858224	1052	**1.029606**
Nebraska	27	0.3192621	423	0.413996
Nevada	1	0.0118245	91	0.089063
New Hampshire	12	0.1418943	119	0.116467
New Jersey	124	**1.466241**	1494	**1.462197**
New York	13	0.1537188	47	0.046
North Carolina	4	0.0472981	84	0.082212
North Dakota	12	0.1418943	106	0.103744
Ohio	9	0.1064207	510	0.499144
Oklahoma	7	0.0827717	115	0.112552
Oregon	19	0.224666	891	0.872033
Pennsylvania	17	0.2010169	265	0.259359
South Carolina	11	0.1300698	153	0.149743
South Dakota	7	0.0827717	24	0.023489
Tennessee	6	0.0709471	52	0.050893
Texas	35	0.4138583	674	0.659653
Utah	69	0.8158922	2623	**2.567164**
Virginia	7	0.0827717	25	0.024468
Washington	17	0.2010169	157	0.153658
West Virginia	4	0.0472981	4	0.003915
Wisconsin	3	0.0354736	84	0.082212
Wyoming	4	0.0472981	12	0.011745
	8457	100	102175	100
Summation	**# Work Orders**	**% WO**	**# Units**	**% Units**
APFO	114	1.35	4956	4.85
Federal	1583	18.72	35479	**34.72**
Public Non-Federal	5933	**70.15**	39972	**39.12**
States	827	9.78	21768	21.31
Total	8457	100.00	102175	100

Largest Customers				
by Work Orders				
Public	5933	**70.15**		
FSA	706	8.35		
NRCS	211	2.49		
EPA	197	2.33		
Forest Service	127	1.5		
New Jersey	124	1.47		
NASS	88	1.04		
Largest Customers				
by Units				
Public Non-Federal	39972	**39.12**		
NRCS	17446	17.07		
Forest Service	6006	5.88		
FSA	3439	3.37		
Iowa	3302	3.23		
APFO GSB	3041	2.98		
BIA	2674	2.62		
Utah	2623	2.57		
EPA	1659	1.62		
Florida	1653	1.61		
California	1549	1.51		
U.S. Army	1507	1.47		
New Jersey	1494	1.46		
Illinois	1494	1.46		
Arizona	1108	1.08		
Montana	1052	1.03		

Appendix 12:
Digital Work Orders
Without APFO and FSA

US Army	1	0.175131	1	0.011348
Forest Service	7	**1.225919**	278	**3.154789**
NRCS	2	0.350263	41	0.465275
National Agri. Statistical Service	3	0.525394	4	0.045393
Fish and Wildlife Service	8	**1.401051**	1676	**19.01952**
National Park Service	6	**1.050788**	125	**1.41852**
Bureau of Indian Affairs	9	**1.576182**	108	**1.225601**
Bureau of Reclamation	2	0.350263	3	0.034044
Bureau of Land Management	6	**1.050788**	18	0.204267
Smithsonian Institute	1	0.175131	1	0.011348
Office of Surface Mining	1	0.175131	110	**1.248298**
Environmental Protection Agency	2	0.350263	3	0.034044
Public Non-Federal	363	**63.57268**	3041	**34.50976**
California	6	1.050788	14	0.158874
Idaho	1	0.175131	1	0.011348
Illinois	2	0.350263	6	0.068089
Iowa	1	0.175131	131	**1.486609**
Kansas	108	**18.91419**	225	**2.553336**
Kentucky	1	0.175131	1	0.011348
Minnesota	9	1.576182	1034	**11.734**
Missouri	2	0.350263	142	**1.611439**
North Dakota	4	0.700525	22	0.24966
Oklahoma	3	0.525394	80	0.907853
Oregon	2	0.350263	4	0.045393
Rhode Island	1	0.175131	113	1.282342
South Dakota	3	0.525394	8	0.090785
Utah	5	0.875657	788	**8.942351**
Vermont	1	0.175131	805	**9.13527**
Virginia	1	0.175131	1	0.011348
Washington	4	0.700525	19	0.215615
Wisconsin	6	**1.050788**	9	0.102133
		0		0
	571	100	8812	100
Summation				
Other Federal	48	8.406305	2368	26.87245
Public	363	63.57268	3041	34.50976
States	160	28.02102	3403	38.61779
Total	**571**	**100**	**8812**	**100**

Largest Customers				
by Work Orders				
Public Non-Federal	363	63.57		
Kansas	108	18.91		
Bureau of Indian Affairs	9	1.58		
Fish and Wildlife Service	8	1.4		
Forest Service	7	1.23		
Wisconsin	6	1.05		
National Park Service	6	1.05		
Bureau of Land Management	6	1.05		
Largest Customers				
by Units				
Public Non-Federal	3041	34.51		
Fish and Wildlife Service	1676	19.02		
Minnesota	1034	11.73		
Vermont	805	9.14		
Utah	788	8.94		
Forest Service	278	3.15		
Kansas	225	2.55		
Missouri	142	1.61		
Iowa	131	1.49		
National Park Service	125	1.42		
Office of Surface Mining	110	1.25		
Bureau of Indian Affairs	108	1.23		