



2006 Civil Commercial Imagery Evaluation Workshop

Access and Availability of Resourcesat-1 AWiFS Data for Agriculture

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Background for USDA-SIA

- **USDA's Satellite Imagery Archive (USDA-SIA)**
 - Established in 2000
 - Must spend funds in private sector
 - Affiliated with USGS/EROS
 - Broad MOU for cooperative efforts.
 - Participating agencies: NASS, FAS, FSA, NRCS, RMA, Forest Service, APHIS
 - Based on annual subscription fees.
- **Prior to FY2006, used to negotiate directly with prime satellite imagery vendors.**
- **FY2006 established contract with Artic Slope Regional Corporation (ASRC)**
 - Government to commercial (FAR clauses)
- **ASRC (prime contractor) established contracts with seven prime satellite imagery vendors**
 - Commercial to commercial (Commercial clauses)

Satellite Imagery Vendors under contract with ASRC MS

1. MDA Geospatial Services-Radarsat International

2. Earthsat (MDA Federal)

3. Eurimage

4. Space Imaging (GeoEye)

5. OrbImage (GeoEye)

6. Digital Globe

7. SPOT

750 products and services

- Multipsectral imagery (2.4 to 60 meters)
- Pan imagery (0.6 to 15 meters)
- Radar
- Services

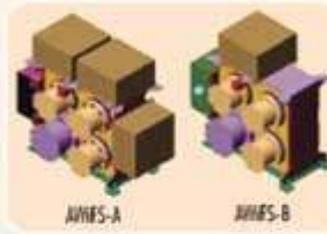
ASRC History

- **Arctic Slope Regional Corporation (ASRC) is one of the original Alaska Native Corporations (ANC) formed in 1971.**
 - The Inupiat Inuit (ASRC) were required to give up rights to all but 5 million of the 56 million acres of the North Slope. Oil was discovered in 1968 in Prudhoe Bay.
- **In return for the land and mineral rights, ANCs are entitled to unique privileges under applicable federal regulations.**
 - ANCs are entitled to receive sole source contracts of any value. They are not subject to the \$3 million limitation applied to other 8(a) entities. 13 C.F.R. 124, 123, 311(b).
 - ANC's may operate multiple 8(a) companies providing that each company operates under a different primary SIC Code or NAICS Code. 108(c) and 112(c)(3).
 - SBA considers only the size of the particular tribal/ANC subsidiary at issue when determining the size of a firm owned by a tribe or ANC. 112(c)(2)(iii).

ASRC History

- **Arctic Slope Regional Corporation (ASRC) has been the largest Alaskan-owned company for 10 years in a row.**
 - \$3.25 billion in assets
 - \$1.3 billion dollars in annual revenue
 - Over 6,500 employees
- **ASRC manages over 5 million acres (remaining from ANCSA)**
 - ASRC has over 9,500 Inupiat shareholders
- **ASRC Management Services is the USDA-FAS prime contractor.**
 - Provides products such as Crop Explorer for Global Crop Production analysis.
 - Procures satellite imagery for USDA agencies and other agencies on an “as-needed” basis.

Resourcesat-1 AWiFS Characteristics



PAYLOADS	LISS-4	LISS-3	AWiFS
Spatial Resolution (m)	5.8	23.5	56
Swath (km)	23.9 (MX mode) 70.3 (PAN mode)	141	740
Spectral Bands (micron)	0.52-0.59 0.62-0.68 0.77-0.86	0.52-0.59 0.62-0.68 0.77-0.86 1.55-1.70	0.52-0.59 0.62-0.68 0.77-0.86 1.55-1.70
Quantisation (bits)	7	7	10
Square Wave Response (at Nyquist)	>0.20	B2 > 0.40 B3 > 0.40 B4 > 0.35 B5 > 0.20	B2 > 0.40 B3 > 0.40 B4 > 0.35 B5 > 0.20
Power (W)	216	70	114
Weight (kg)	169.5	106.1	103.6
Data Rate (MBPS)	105	52.5	52.5

- Broad swath : AWiFS-A, AWiFS-B, each with a swath width of 350 km
- Four Bands: including SWIR
- High revisit rate: 5 to 24 days, depending on scene selection.

USDA Uses Resourcesat-1 Satellite Data

- Resourcesat-1 launched October 17, 2003
- Sample data to USDA/NASS August, 2004
- Sample data to USDA/FAS December, 2004
- Purchases by USDA/NASS August, 2004
- Purchases by USDA/FAS November, 2005
- First standing order December, 2005
- Current USDA Inventory: 242 scenes

Access and Availability

- **Delay in use results from:**

- Concerns about data quality

- Geometric and radiometric

- Applications for 56 meter resolution data.

- Poor initial delivery terms

JACIE continues to examine and characterize

USDA NASS continues to examine data for its Crop Land Data Layer

USDA SIA Contract emphasizes access and availability

Access and Availability Topics

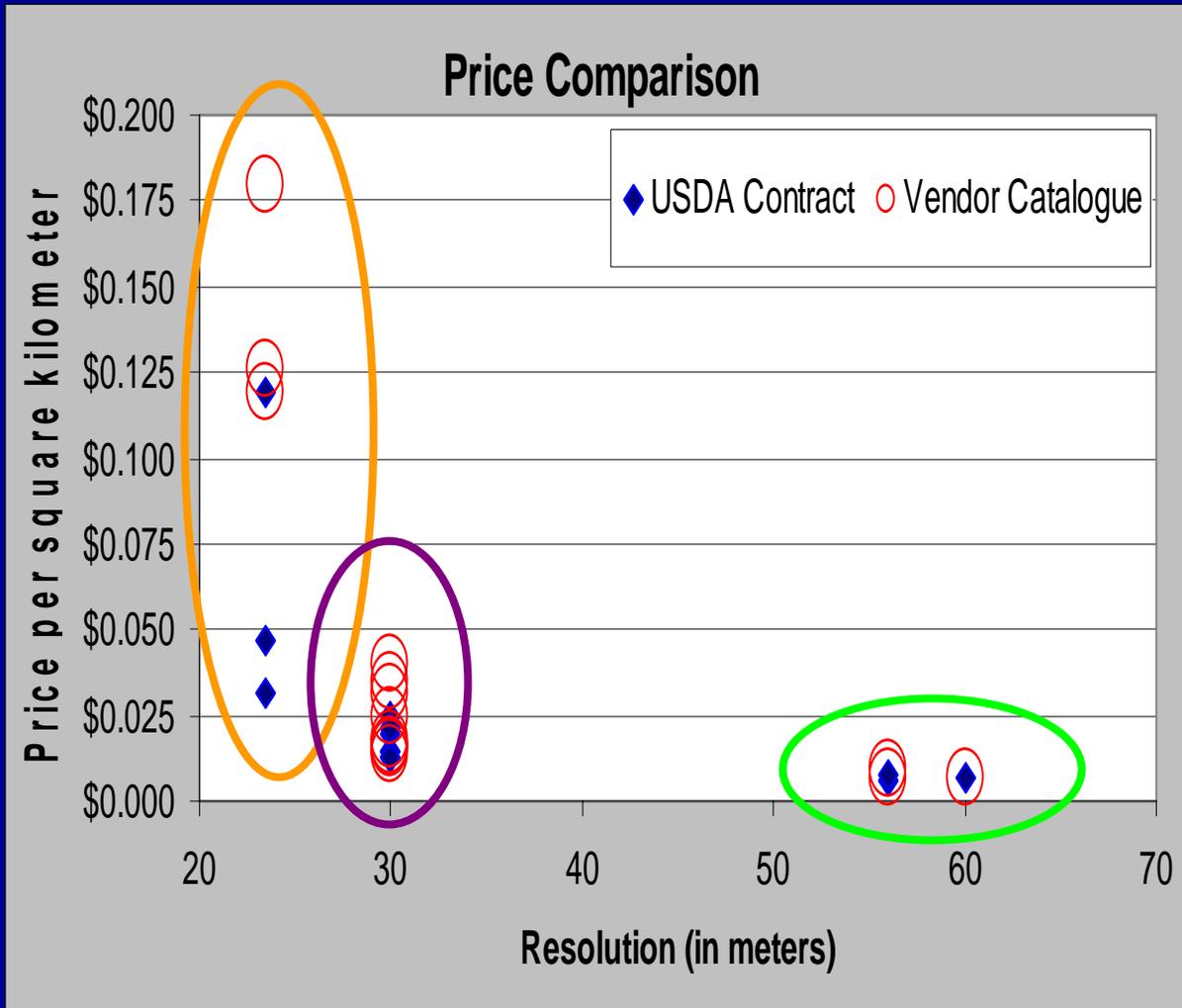
- **Contract**
 - Prices on a per scene basis or per AOI.
 - Delivery dates and formats
 - Enforceable terms
 - Availability of products and services
- **Coverage**
- **Acquisition Planning**
- **Distribution/Re-distribution**

Access to Resourcesat-1 AWiFS Data: **Contract**

a means of approaching, communicating with, or making use of

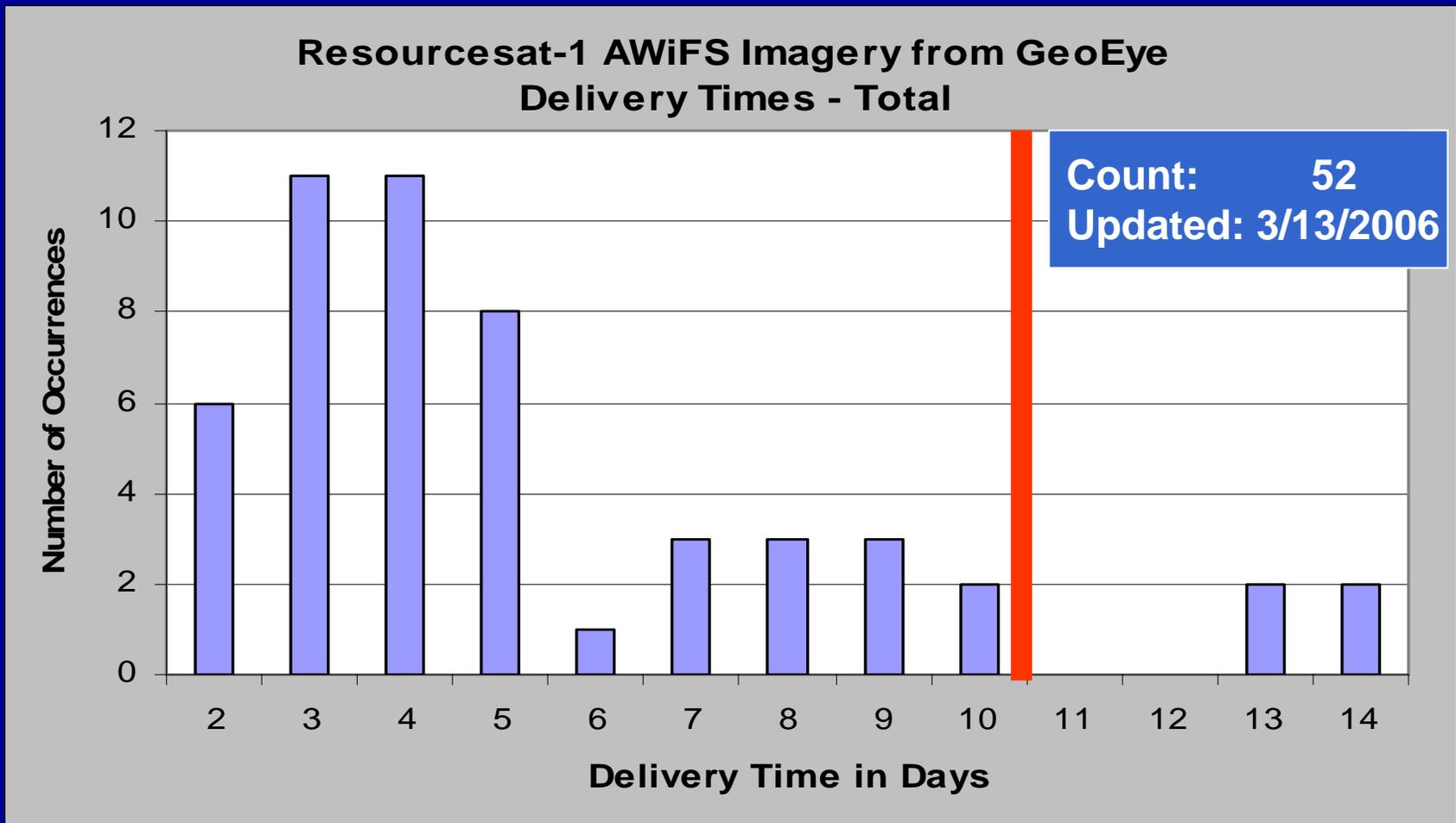
- GeoEye/Space Imaging is the distributor of Resourcesat-1 and IKONOS data.
- **Contract Highlights**
 - Price
 - AWiFS orthorectified Quad -- \$924
 - Scene identification are Path: Row: Quad: Acquisition Date
 - Format
 - Orthorectified LCC, WGS-84, 8-bit, 4-band, Geo-TIFF
 - Delivery terms
 - Less than 10 calendar days after acquisition date (non-North America)
 - Less than 5 days for North America
 - License for Distribution/Redistribution
 - Tier 2 (Federal/Civilian agencies)

Access to Resourcesat-1 AWiFS Data: *Price*



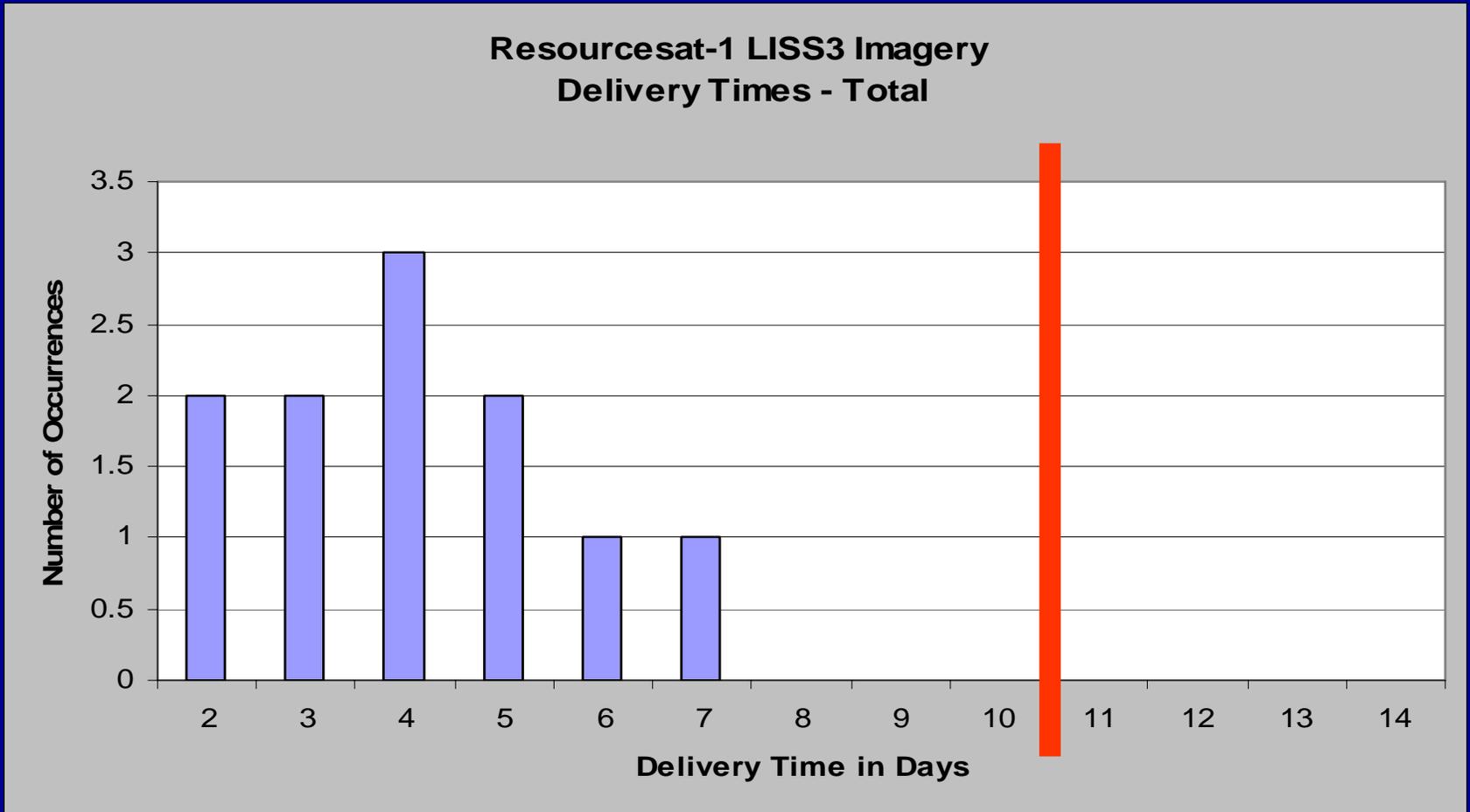
- **USDA is a price-sensitive purchaser of satellite imagery.**
- **Contract prices are lower than vendor's catalogue prices.**
- **Prices for LISS3 are higher than Landsat.**
- **AWiFS prices are lower than Landsat.**

Access to Resourcesat-1 AWiFS Data: *Delivery*



AWiFS Delivery for South American imagery has met and *exceeded* contract specifications

Access to Resourcesat-1 LISS3 Data: *Delivery*



LISS3 Delivery for South American imagery has met and *exceeded* contract specifications

Access to Resourcesat-1 AWiFS Data: **Coverage**

a means of approaching, communicating with, or making use of

- **Coverage**

- International Ground Stations
- Standing Orders
 - Start date
 - End Date
 - Path/Row/Quad

- South America

- **Russia and Ukraine**

- **North Africa**

- **Europe**

- **North America**

Pending

Access to Resourcesat-1 Data: *Coverage*



Source: http://www.spaceimaging.com/whitepapers_pdfs/IRSwhitepaper_LoRes.pdf

- **Coverage for areas outside of communication cones achieved through new Svalbard, Norway ground station.**

Access to Resourcesat-1 AWiFS Data: **Coverage**

a means of approaching, communicating with, or making use of

Resourcesat-1 AWiFS and LISS3 Coverage for South America 2005/06 Standing Order



229 AWiFS

32 LISS3

~\$250,000



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<http://www.pecad.fas.usda.gov/>

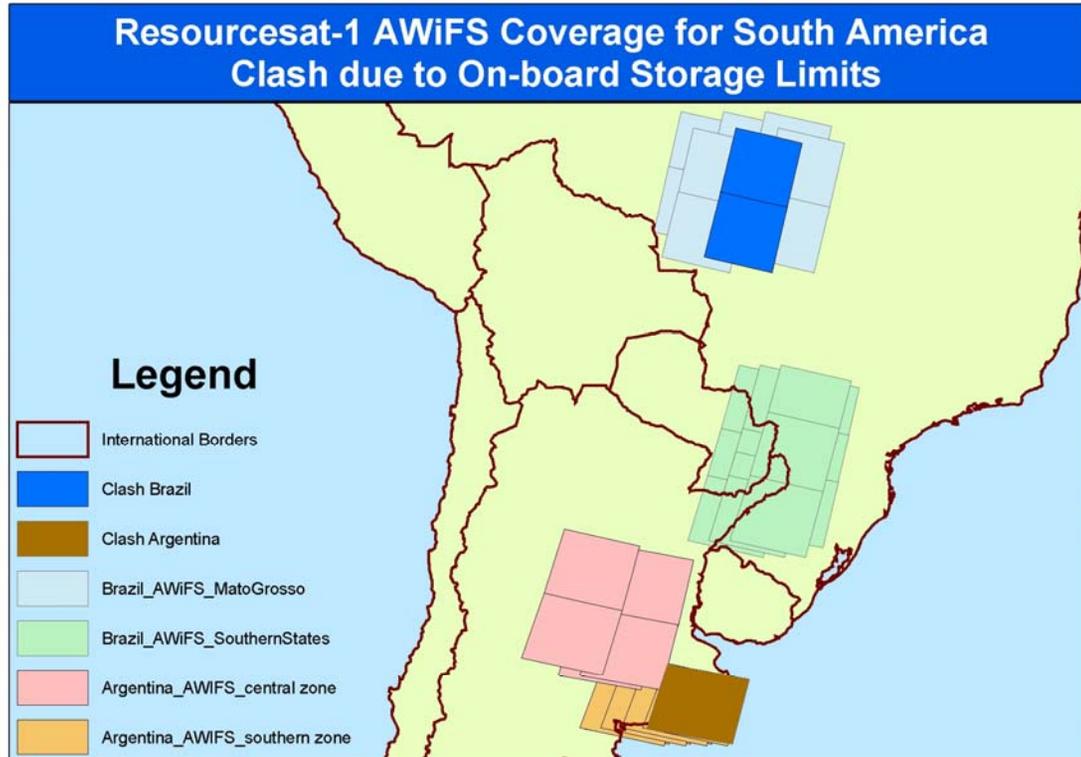
Availability of Resourcesat-1 AWiFS Data: *Planning*

present and ready for use; at hand; accessible

- **On-board storage**
 - Clashes in South America
 - Norway ground station may alleviate many clashes.
 - Can the satellite acquire many scenes?
 - How many?
- **Real-time collection mode (collect and downlink simultaneously) alleviates the problem with on-board storage**
 - US acquisitions should be OK.
 - Test planned for June through August 2006.

Availability of Resourcesat-1 AWiFS Data: *Planning*

present and ready for use; at hand; accessible



USDA Satellite Imagery Archive
Foreign Agricultural Service
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- On-board storage has a capacity of 120GB, which is ~ 9 minutes.
- Same-day / same-path clashes occur for first and last scenes in path.
- Either take Brazil or Argentina

Availability of Resourcesat-1 AWiFS Data: *Planning*

present and ready for use; at hand; accessible

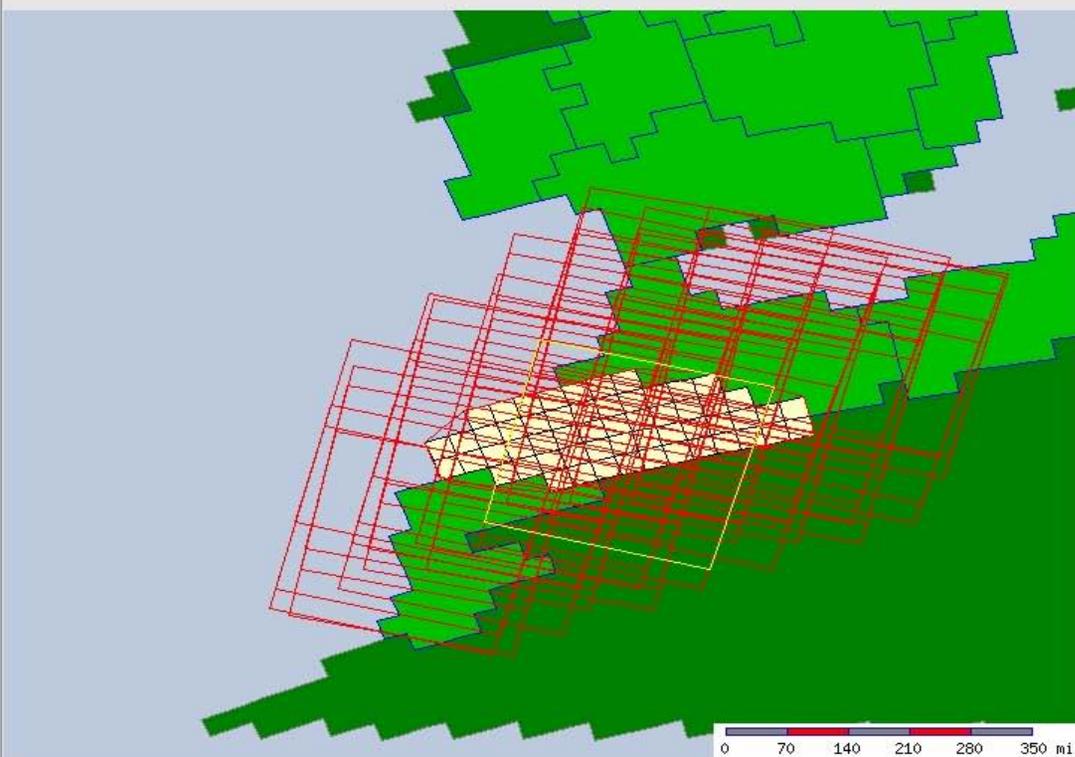
- **Acquisition Planning**

- Is there a shapefile of path/rows?
 - **AWiFS**
 - **LISS3**
 - **LISS4**
- Can you predict opportunity dates?
- Is the satellite “on”? Or is it on only when there is an order?



Production Estimates and Crop Assessment Division

Create Task Order Review Task Order Submit Task Order



0 70 140 210 280 350 mi



Map scale: 1:7874557
Click x,y: -7.550000,33.725000
Map Extent: -16.550000 26.975000 1.450000 40.475000

Legend, Display, and Query panels. Legend includes AWIFS (best), AWIFS (max), AFWA: Convex Hull, AFWA: Grid Cells, Subregions, and Regions. Display includes Layers (AFWA Sub-Regions, AFWA Grid Cells, AWIFS) and Navigation (Pan, Zoom In, Zoom Out, Zoom Extent). Query includes Gazetteer (Regions: Africa-North, Sub-Regions: Central Morocco), Date Range (Begin Date: 1/1/2005, End Date: 1/15/2005), Comparison (>), and Scenes Over Grid Cell (0). Includes Run Query and Refresh buttons.

Availability of Resourcesat-1 AWiFS Data: *Planning*

present and ready for use; at hand; accessible

- **Acquisition Planning**

- Is there a shapefile of path/rows?
 - AWiFS
 - LISS3
 - LISS4
- Can you predict opportunity dates?
 - **Yes, data from *P6_data_user_handbook.pdf***
- Is the satellite “on”? Or is it on only when there is an order?

Path	167	172	177	182	187	168	173	178	183	188	169	174	179	184	189	170	175	180	185	190	171	176	181	186
	143	148	153	158	163	144	149	154	159	164	145	150	155	160	165	146	151	156	161	166	147	152	157	162
	119	124	129	134	139	120	125	130	135	140	121	126	131	136	141	122	127	132	137	142	123	128	133	138
	95	100	105	110	115	96	101	106	111	116	97	102	107	112	117	98	103	108	113	118	99	104	109	114
	71	76	81	86	91	72	77	82	87	92	73	78	83	88	93	74	79	84	89	94	75	80	85	90
	47	52	57	62	67	48	53	58	63	68	49	54	59	64	69	50	55	60	65	70	51	56	61	66
	23	28	33	38	43	24	29	34	39	44	25	30	35	40	45	26	31	36	41	46	27	32	37	42
	340	4	9	14	19	341	5	10	15	20	1	6	11	16	21	2	7	12	17	22	3	8	13	18
	316	321	326	331	336	317	322	327	332	337	318	323	328	333	338	319	324	329	334	339	320	325	330	335
	282	297	302	307	312	283	298	303	308	313	294	299	304	309	314	295	300	305	310	315	296	301	306	311
	268	273	278	283	288	269	274	279	284	289	270	275	280	285	290	271	276	281	286	291	272	277	282	287
	244	249	254	259	264	245	250	255	260	265	246	251	256	261	266	247	252	257	262	267	248	253	258	263
	220	225	230	235	240	221	226	231	236	241	222	227	232	237	242	223	228	233	238	243	224	229	234	239
	196	201	206	211	216	197	202	207	212	217	198	203	208	213	218	199	204	209	214	219	200	205	210	215
					192					193					194					195				191
Jan	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31																	
Feb	18	19	20	21	22	23	24	25	26	27	28	29												
Mar	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5
Apr	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
	30																							
May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
	24	25	26	27	28	29	30	31																
Jun	17	18	19	20	21	22	23	24	25	26	27	28	29	30										
Jul	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Aug	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	28	29	30	31																				
Sep	21	22	23	24	25	26	27	28	29	30														
Oct	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31							
Nov	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Dec	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	26	27	28	29	30	31																		

Table 4.2.1 Typical Orbital Calendar of IRS-P6

Availability of Resourcesat-1 AWiFS Data: *Planning*

present and ready for use; at hand; accessible

- **Acquisition Planning**

- Is there a shapefile of path/rows?
 - AWiFS
 - LISS3
 - LISS4
- Can you predict opportunity dates?
 - Yes, data from *P6_data_user_handbook.pdf*
- Is the satellite “on”? Or is it on only when there is an order?
 - **Only acquiring when there is an order.**
 - **Order for AWiFS data results in collects for LISS3 (unless specifically turned off.)**

Availability of Resourcesat-1 AWiFS Data: *Distribution*

present and ready for use; at hand; accessible

- **Distribution/Redistribution**

- USDA-SIA determines which IRS scenes will be bought

- Input from participating USDA agencies.
- Mixture of AWiFS and LISS3
- Limited budget

- IRS scenes bought through USDA's contract have Fed/Civil license.

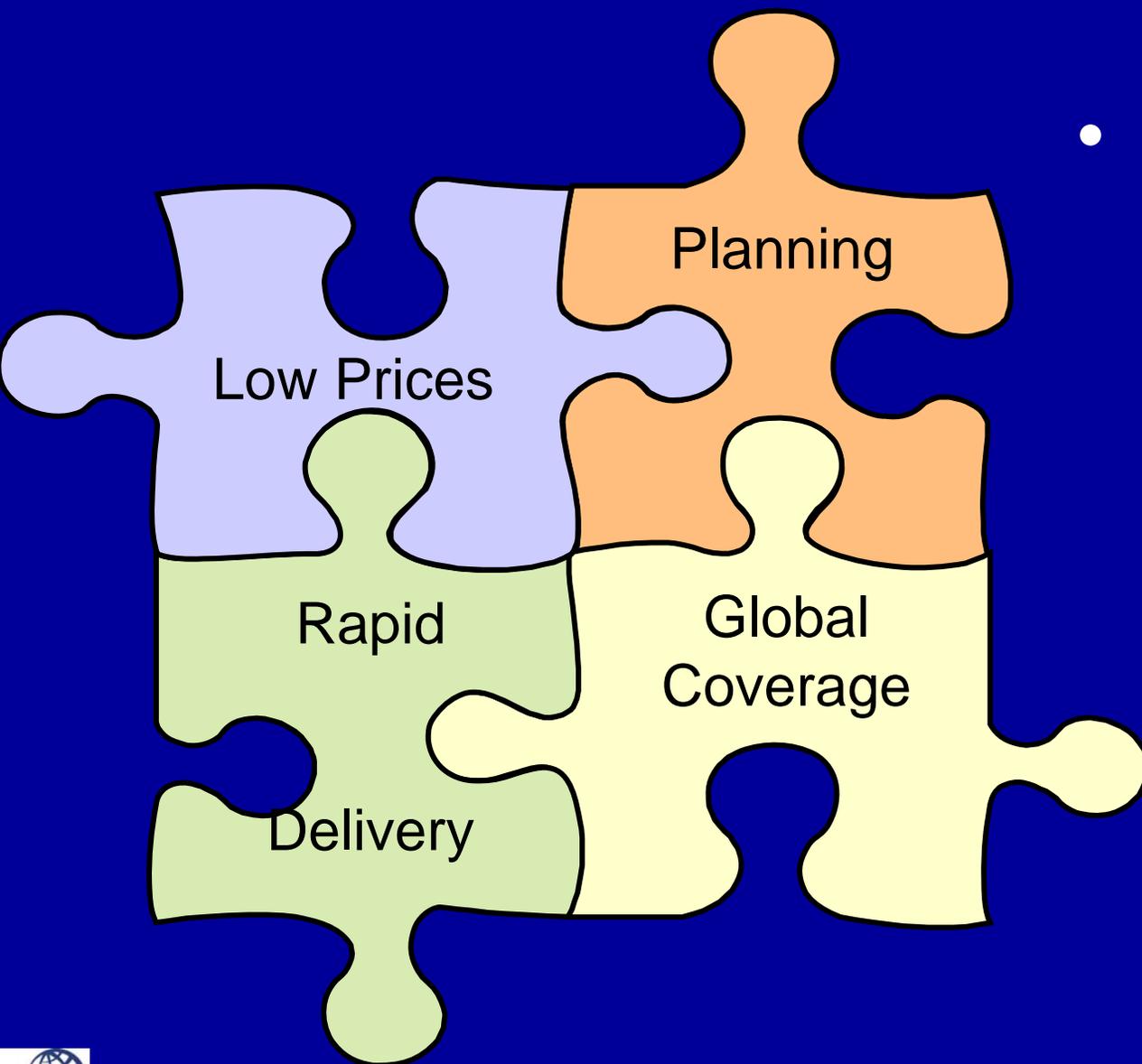
- Redistribution

- Archive Explorer (web-based application)
 - Restricted use to participating agencies

- Data swapping with USGS/EROS
- Access to Indian Archive

} *Pending*

Access and Availability of Resourcesat-1 AWiFS Data



- **AWiFS data has elements for successful applications in agriculture.**
 - Low Prices
 - Rapid Delivery
 - Acquisition Planning
 - Global Coverage

Availability of Resourcesat-1 AWiFS Data: *Purchase*

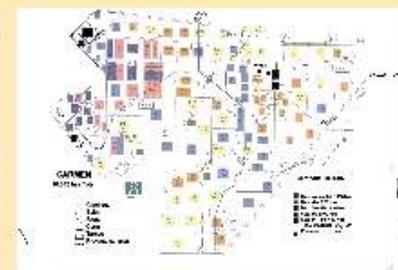
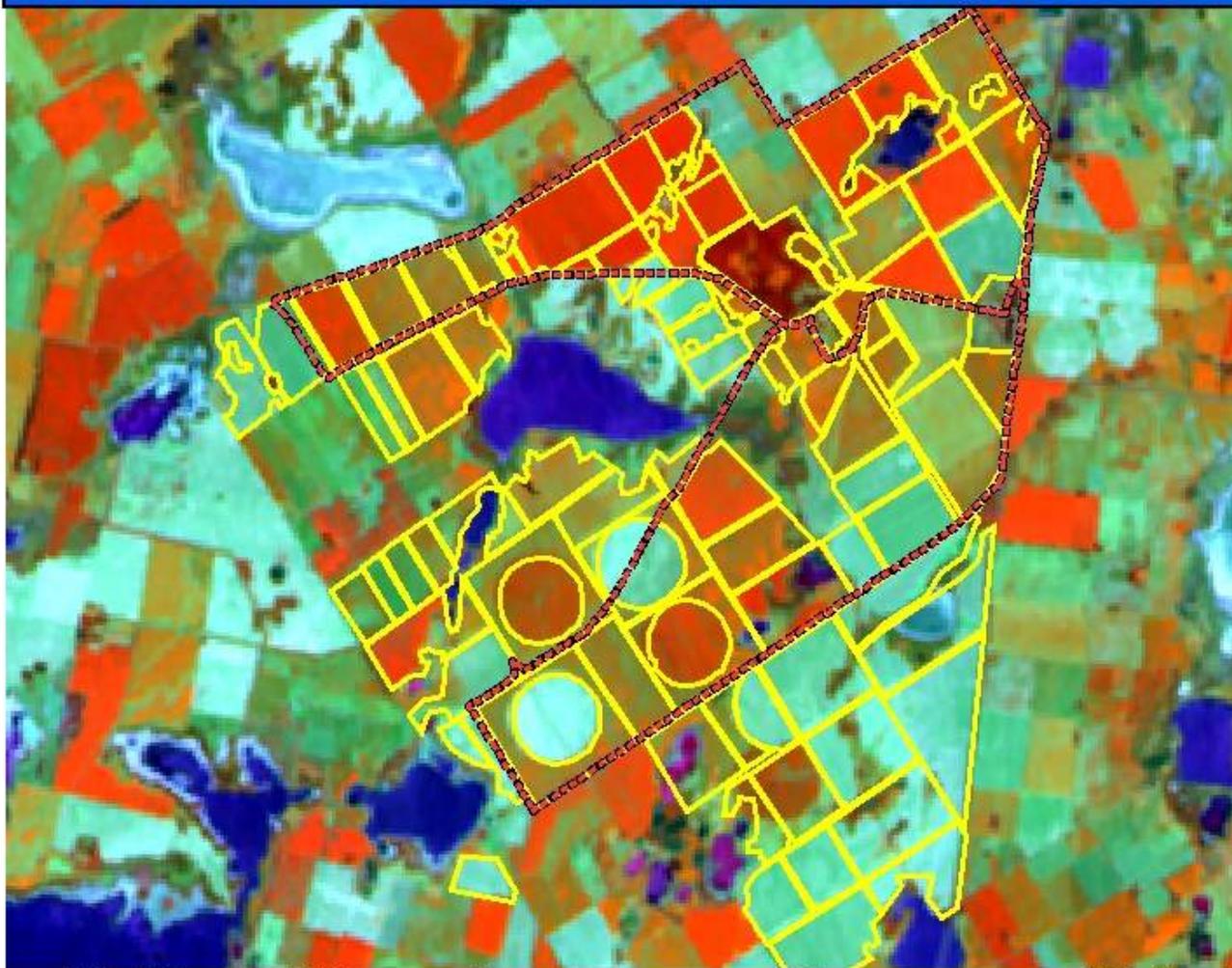
present and ready for use; at hand; accessible

Ordering data through USDA-SIA:

1. Contact Bob Tetrault (COTR) to place an order
 - robert.tetrault@usda.gov
 - Call Bob Tetrault at 202-690-0130
2. Send detailed requirements (Agency to USDA-SIA)
3. Review bids (Agency and USDA-SIA)
4. Transfer funds via AD-672 (Agency to USDA-SIA)
5. Receive imagery

El Carmen: December 26, 2005

Venado Tuerto Delegation, Santa Fe Province, Argentina



El Carmen Field Map
Courtesy of ADECO



Fieldwork 2005

-  GPS tracks
-  Fields_0405

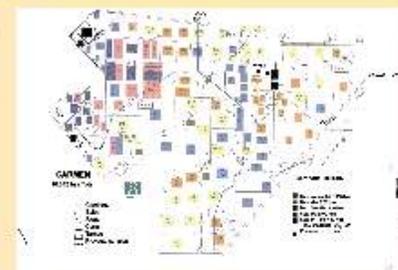
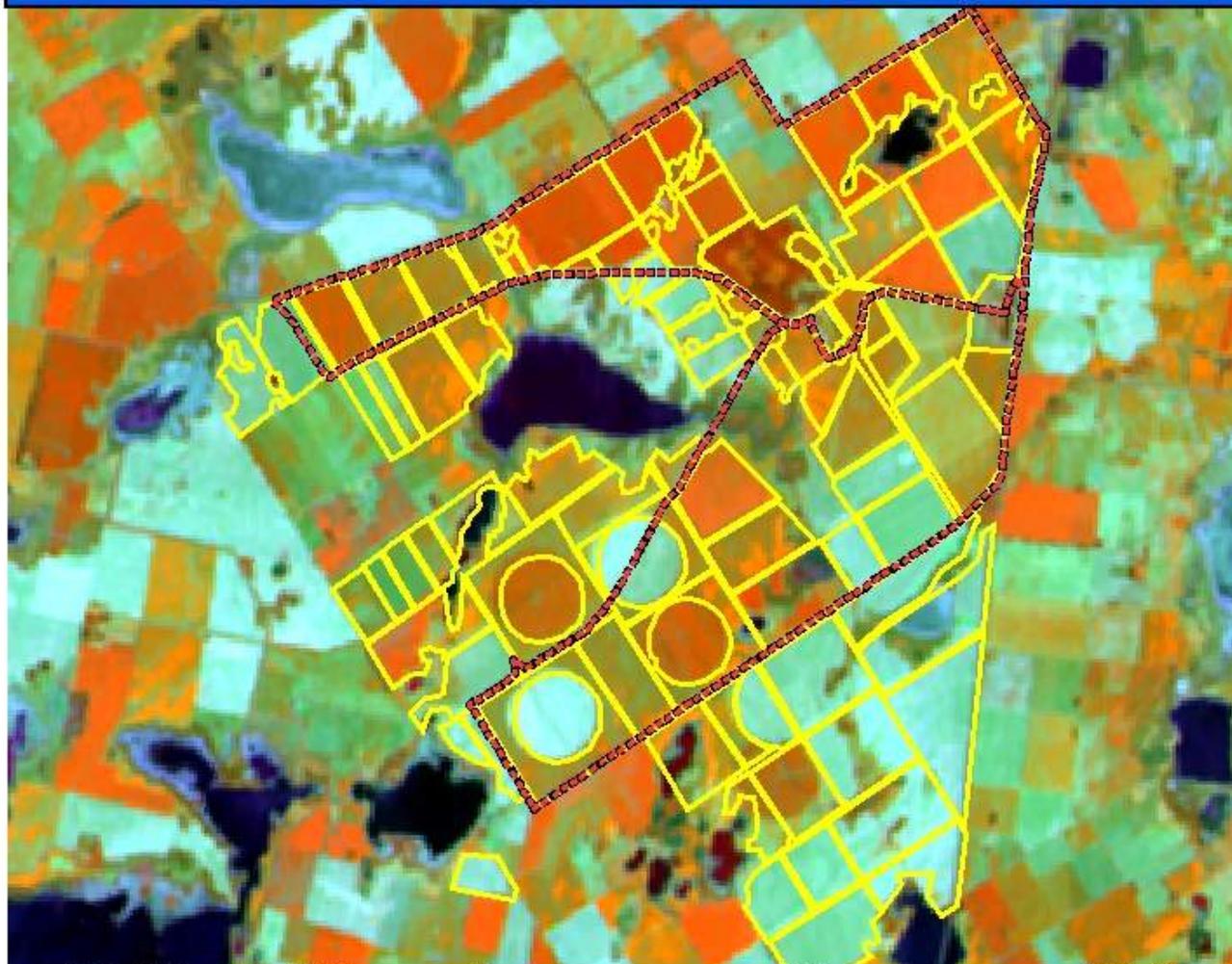


U.S. Department of Agriculture
Foreign Agricultural Service
Production Estimates and Crop Assessment Division
<http://www.pecad.fas.usda.gov/>

Field Data: USDA/FAS/PECAD
Image Data: IRS-AWIFS (IR, SWIR, R)
Projection: Lambert Conformal Conic, WGS 84
Contact: Nicole.C.Wagner@usda.gov

El Carmen: December 31, 2005

Venado Tuerto Delegation, Santa Fe Province, Argentina



El Carmen Field Map
Courtesy of ADECO



Fieldwork 2005

- GPS tracks
- Fields_0405

4,300 2,150 0 4,300 8,600 Meters

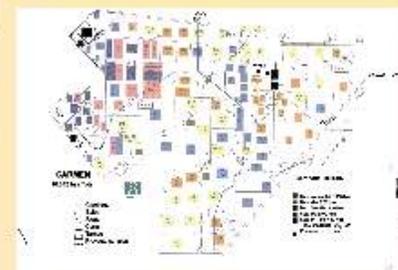


U.S. Department of Agriculture
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<http://www.pecad.fas.usda.gov/>

Field Data: USDA/FAS/PECAD
Image Data: IRS-AWIFS (IR, SWIR, R)
Projection: Lambert Conformal Conic, WGS 84
Contact: Nicole.C.Wagner@usda.gov

El Carmen: January 19, 2006

Venado Tuerto Delegation, Santa Fe Province, Argentina



El Carmen Field Map
Courtesy of ADECO



Fieldwork 2005

- GPS tracks
- Fields_0405

4,300 2,150 0 4,300 8,600 Meters



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Contact: Nicole.C.Wagner@usda.gov

Next Steps

Input into Requirements for Resourcesat-2

- USDA Foreign Agricultural Service will be organizing a workshop on applications of Resourcesat-1 data for agriculture.
 - Participants include
 - ISRO (Indian Space Research Organization)
 - ANTRIX (Marketing and commercial arm of ISRO)
 - GeoEye (worldwide distributor of Resourcesat-1 data)
 - USDA agencies
 - Others?
- If interested, please contact Bob Tetrault at
 - 202 690-0130
 - Robert.tetrault@usda.gov