SPOT Satellite Earth Observation System
Presentation to the
JACIE Civil Commercial Imagery Evaluation Workshop
March 2007

Topics Presented

- Quick summary of system characteristics
- Formosat-2 Satellite
- Archive operations
- DTED2 Digital Elevation Model Product—Reference3D
- Web-based operations

SPOT Space Segment Today

- 3 Satellite constellation currently operational
- SPOT 2 & SPOT 4 10m Pan, 20m XI
- SPOT 5 – Launched in mid 2002
  - Improved resolution 10m XI, 5m Pan, 2.5m Pan
  - Dedicated instrument for stereo imagery collection
- Over 100M km2 of 2.5m and 5m Data in the archive

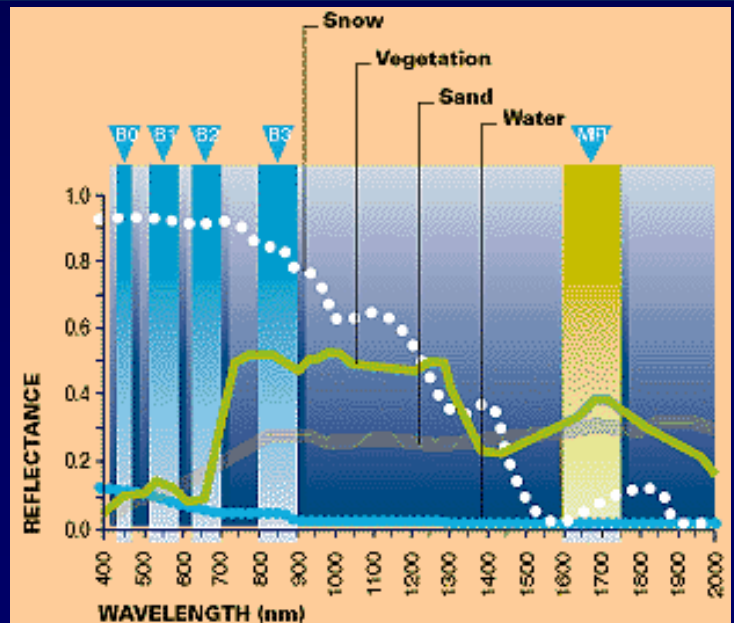
Tel Aviv, Israel - SPOT 2.5m Color

Hong Kong, China - SPOT 2.5m Color

Madrid, Spain - SPOT 2.5m Color

SPOT System – Spectral Mode

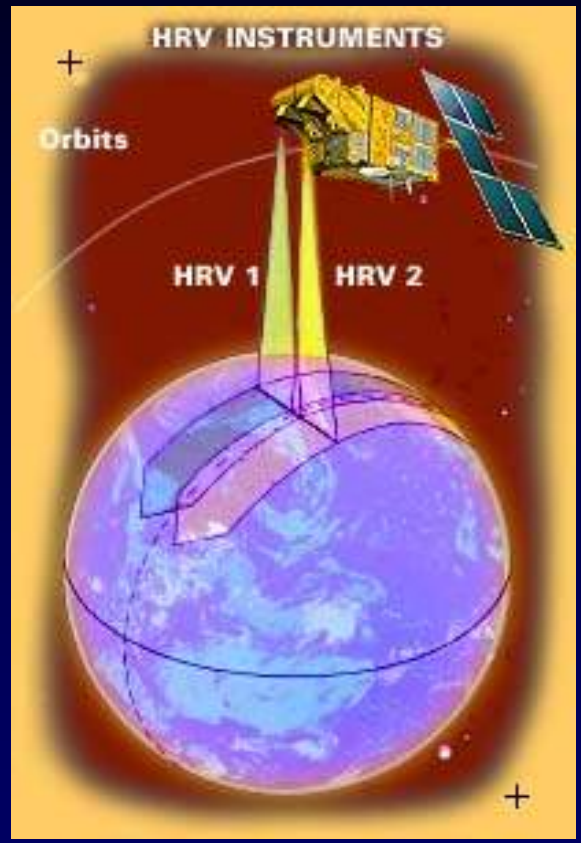
Mode	Spatial Resolution (Meters)	SPOT 1-3 Spectral Resolution (Microns)	SPOT 4 Spectral Resolution (Microns)	Spatial Resolution (Meters)	SPOT 5 Spectral Resolution (Microns)
Panchromatic	10m	0.51 - 0.73	0.61 - 0.68	2.5& 5m	0.51 - 0.73
Multispectral	20m	0.50 - 0.59 (Green) 0.61 - 0.68 (Red) 0.79 - 0.89 (Near IR)	0.50 - 0.59 (Green) 0.61 - 0.68 (Red) 0.79 - 0.89 (Near IR) 1.58 - 1.73 (Mid IR)	10m 10m 10m 20m	0.50 - 0.59 (Green) 0.61 - 0.68 (Red) 0.79 - 0.89 (Near IR) 1.58 - 1.73 (Mid IR)

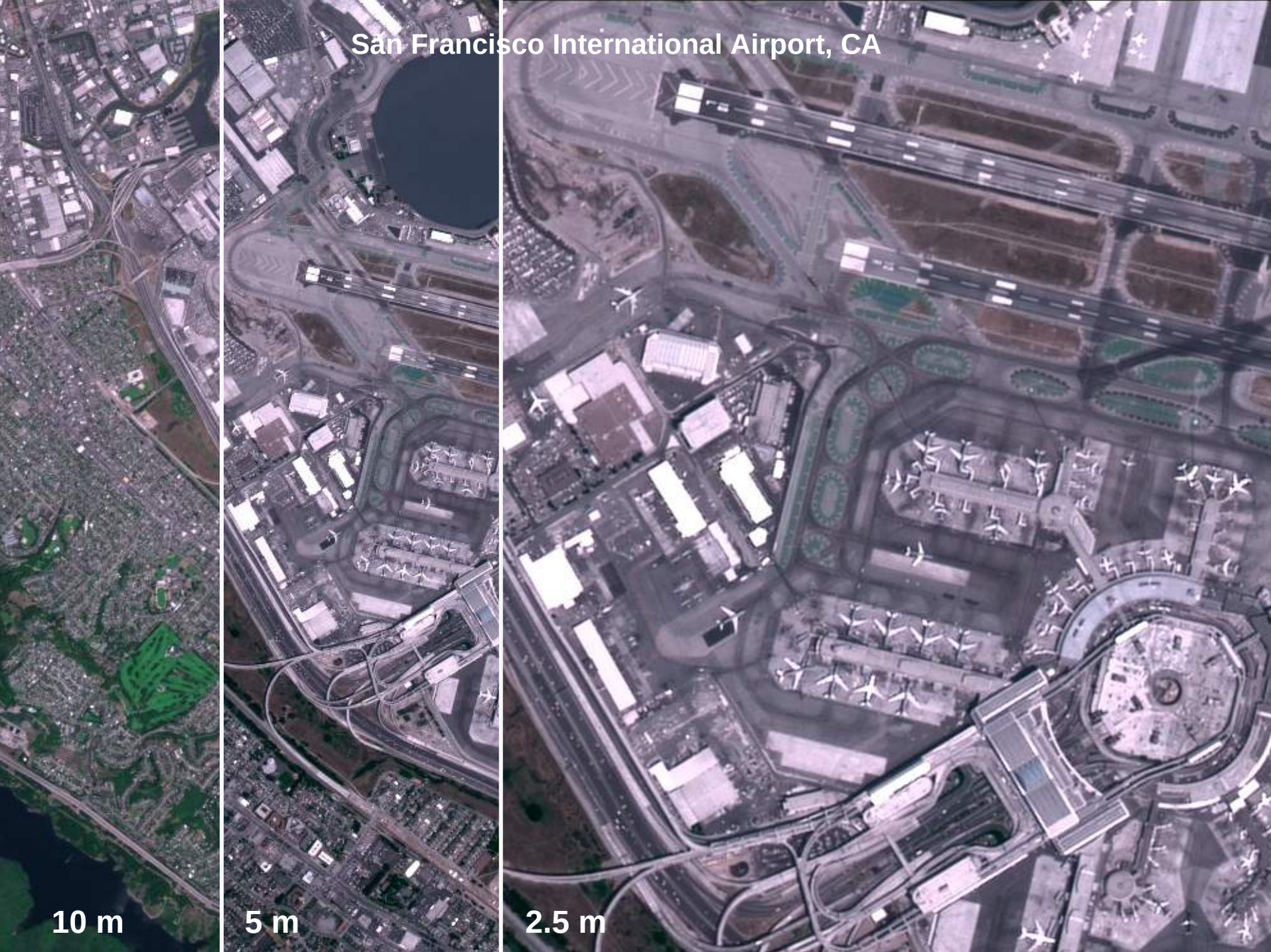


SPOT 5 Major Improvements

Improvements

- Increased Spatial Resolution (HRV)
  - 2.5 m Panchromatic
  - 5 m Panchromatic
  - 10 m Multispectral
- Dedicated Stereo Instrument (HRS)
  - High Resolution Stereoscopic
  - Fore & aft fixed stereo, 120 X 600 KM strips
- Improved Location Accuracy
  - < 50 m (RMS) without ground control




San Francisco International Airport, CA
10 m
5 m
2.5 m

Resolution Comparison: SPOT 5 to Ikonos
Madrid, Spain, Train Station

SPOT 2.5 M

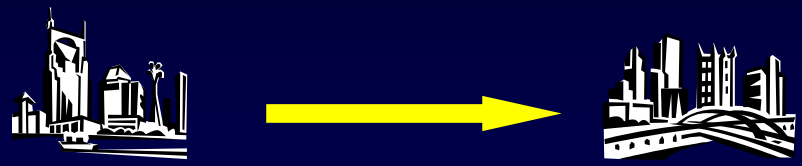
Natural Color

Ikonos 1 M

Natural Color

Low-density Populated Areas

- Do you really need sub-1m data outside the city?



Point A *Point B*

- Appropriate resolution -- based upon population density, traffic, feature density and feature significance
- SPOT 2.5m and 5m provides effective and efficient coverage between cities
- Ensure continuity in coverage and appropriate update cycles

CCAP Accuracy/Quality Evaluation by NGA, Jan-Feb 2006

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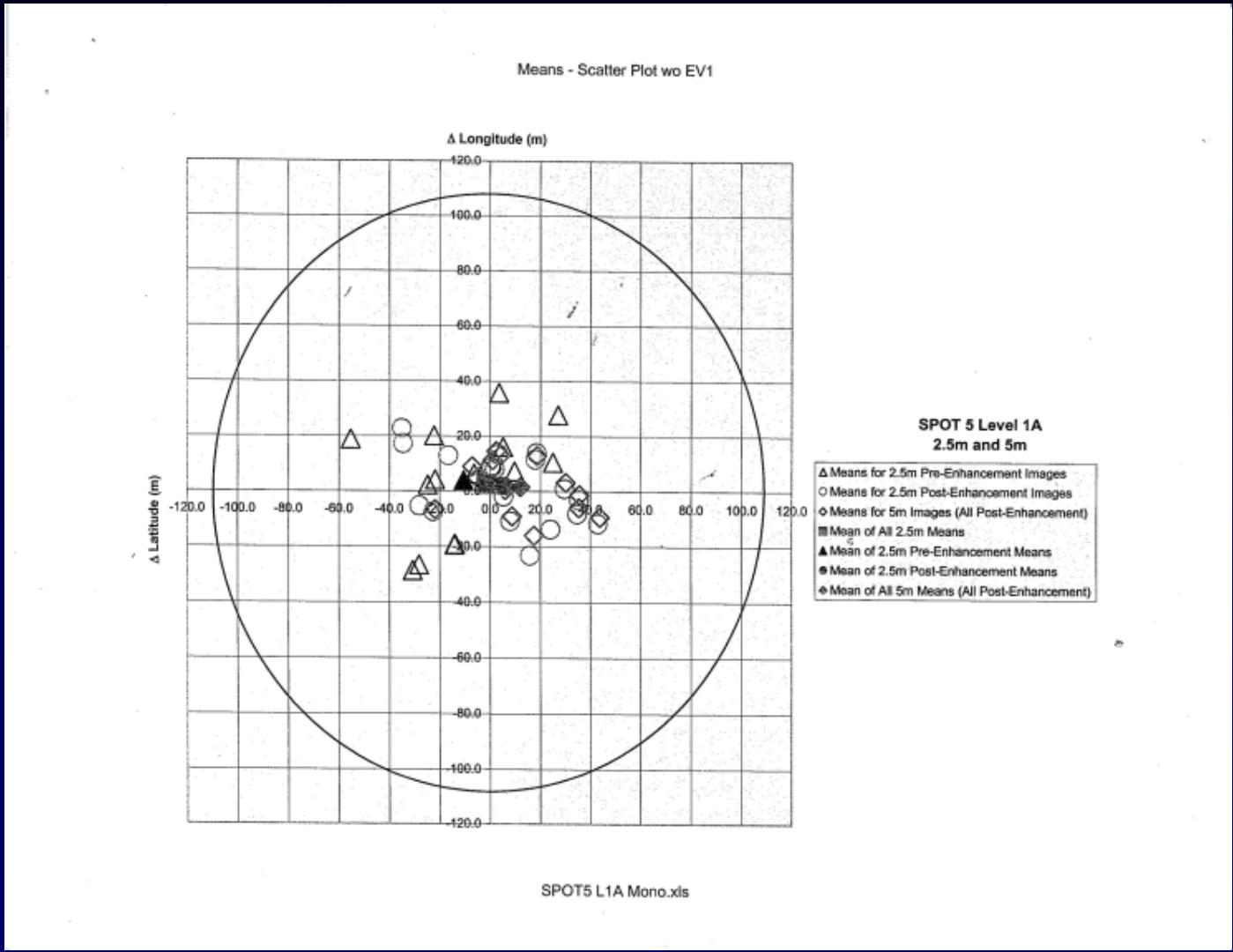
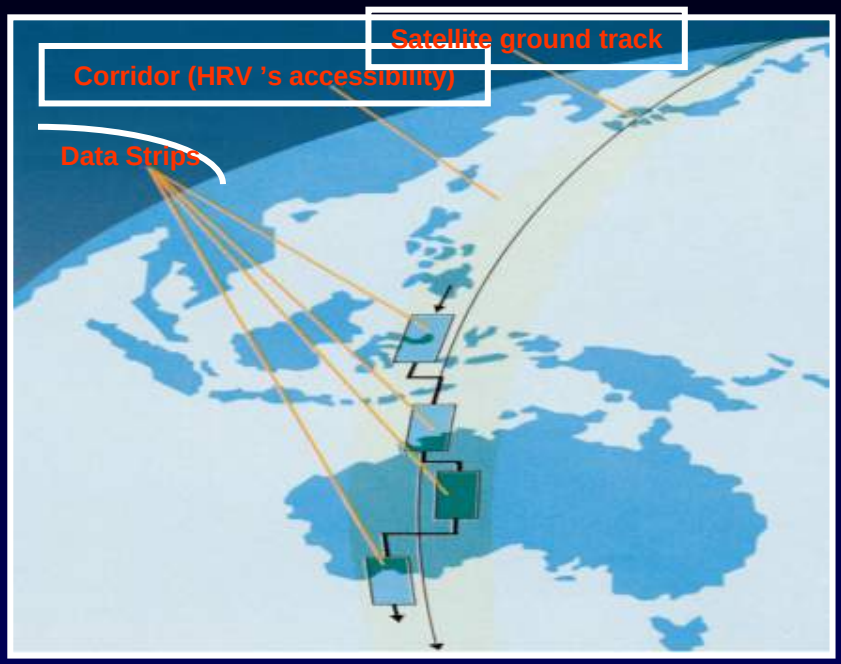
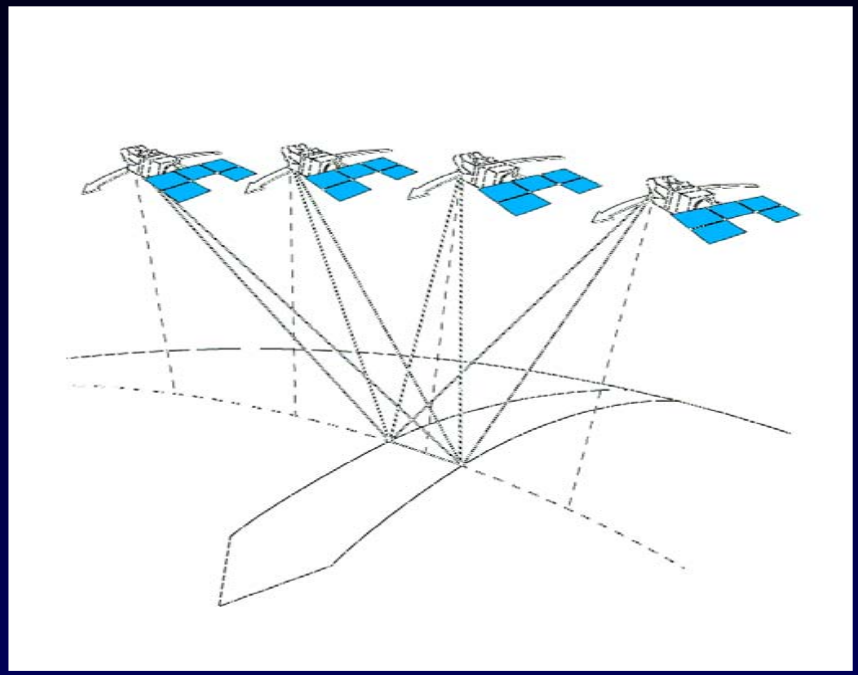
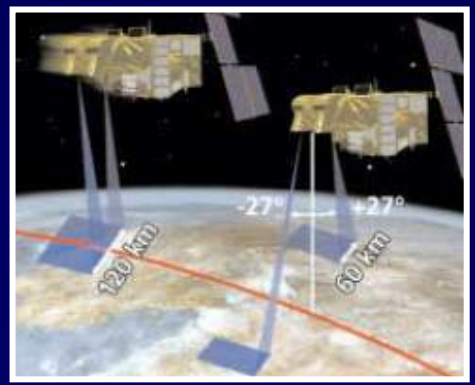


SPOT Satellite – Viewing Capabilities

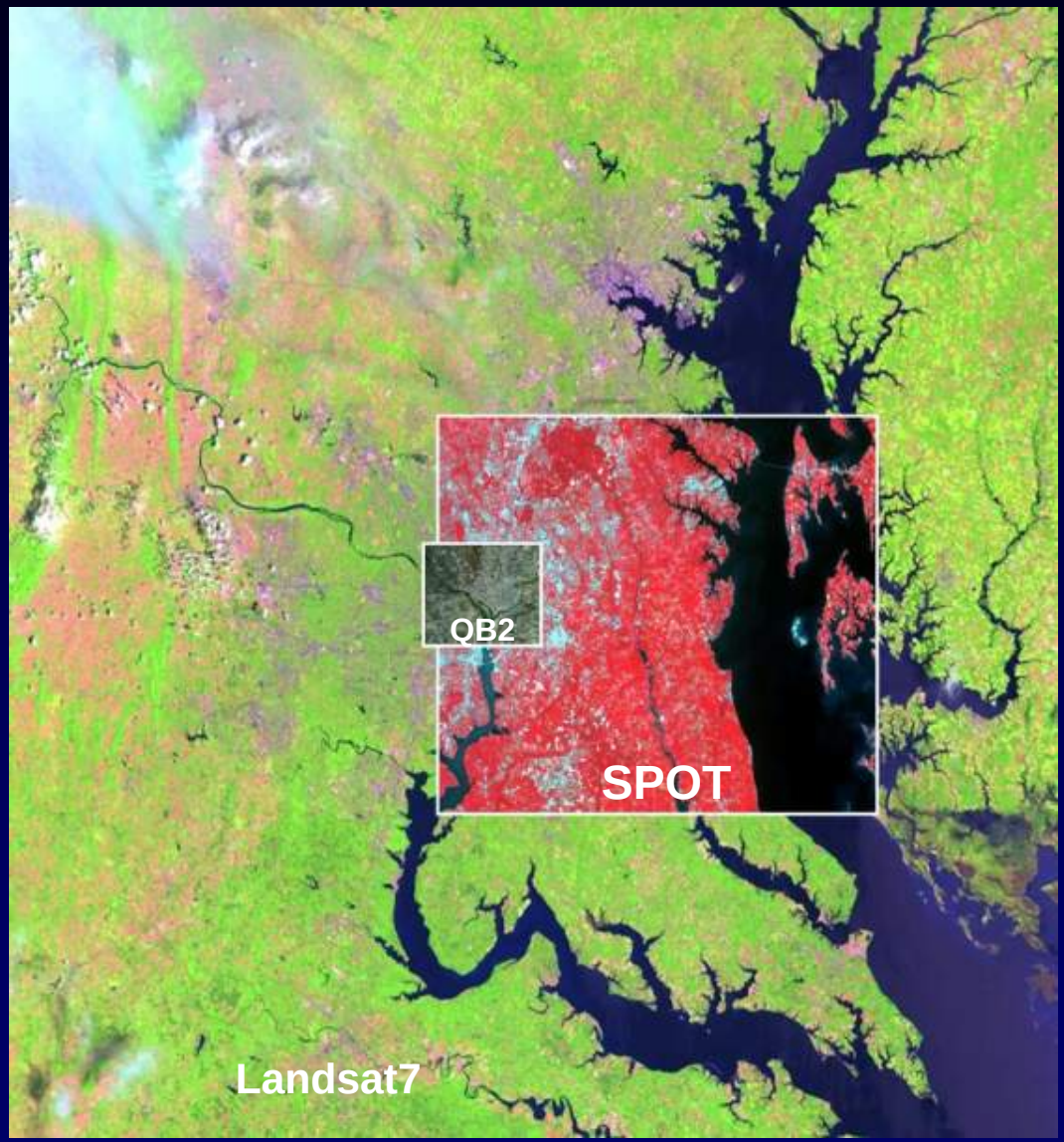




Scene Accessibility (26 days cycle)	# of scenes
HRV/HRG - +/- 31 deg incidence angle	9 scenes (equator) 13 scenes (45 deg latitude)
HRV/HRG – Nadir Viewing	1 scene (equator) 2 scenes (60 deg latitude)



SPOT Scene - Coverage

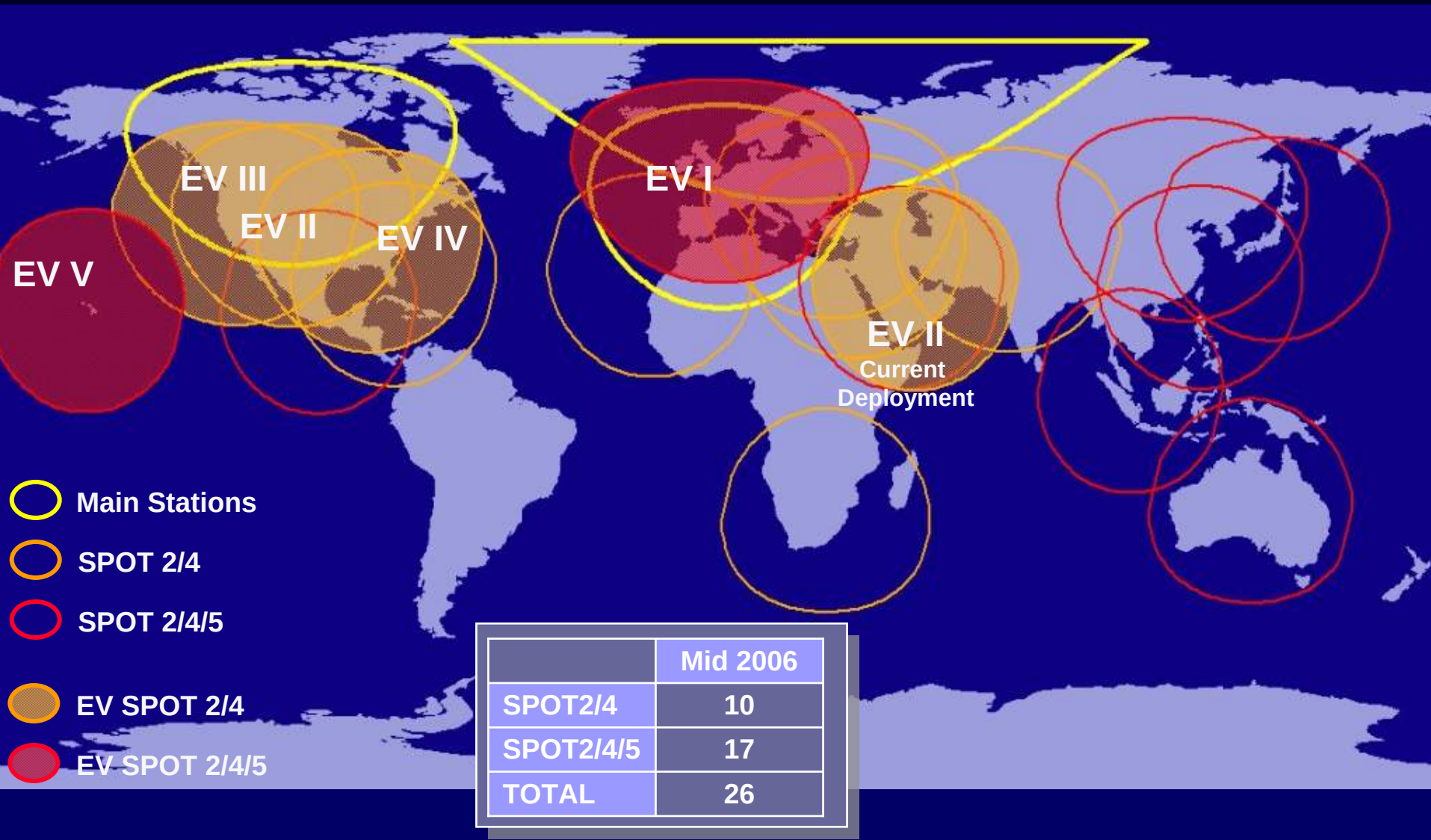


- 60x60km scene
- 2 cameras per satellite
- Total of 6 imaging cameras using all 3 satellites

Scene Requirements

Coverage	SPOT5	Quickbird
60x60km Scene	1	~15
30min frame	1-3	10-25
1x1deg geocell	7-9	~60

SPOT Ground Station Network



	Mid 2006
SPOT2/4	10
SPOT2/4/5	17
TOTAL	26

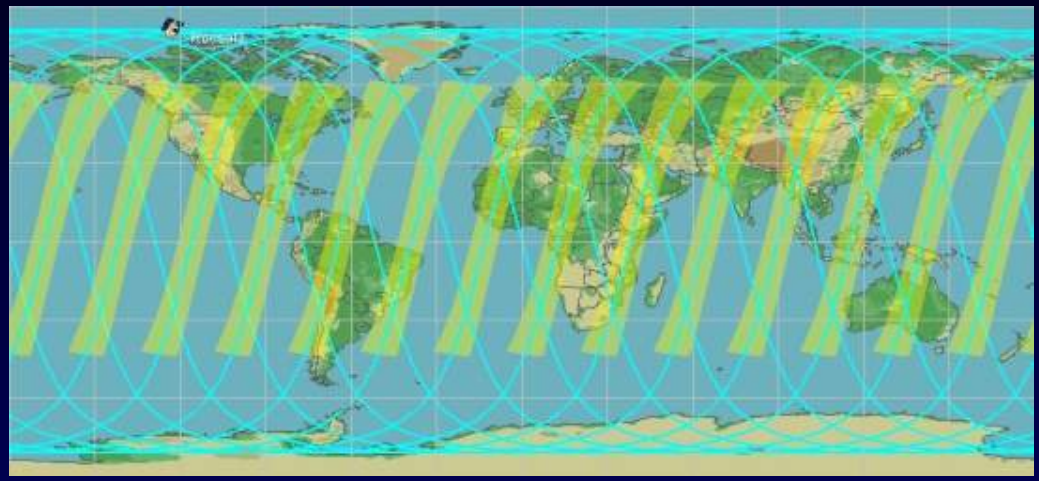
FORMOSAT-2

- Owned by NSPO (National Space Program Office), Taiwan
- Satellite, instrument & bus designed and manufactured by Astrium
- Designed to answer monitoring with high revisit frequency needs
  - 24km Swath
  - 2m Pan, 8m Multispectral
  - Daily revisit frequency

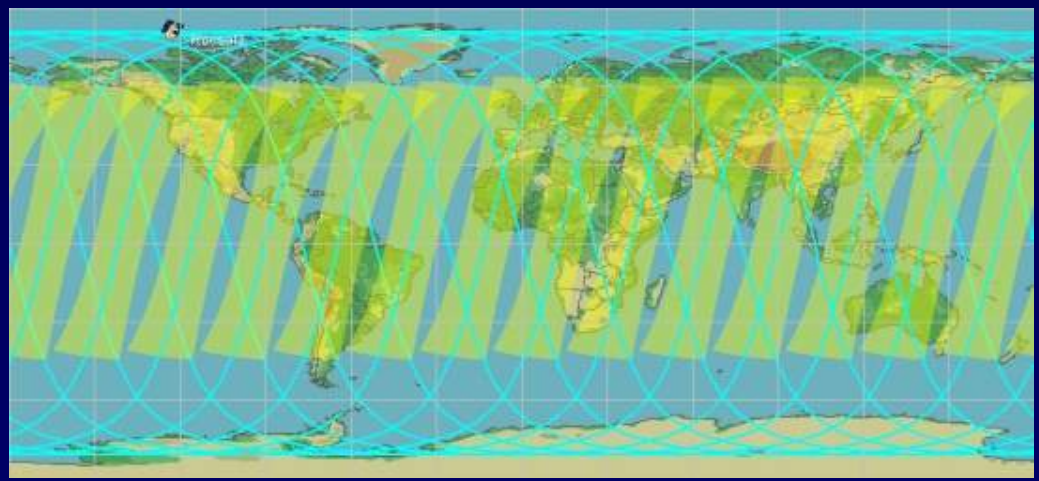
Band	Res. (m)	Spectral (μm)
Pan	2m	0.45~0.90
MS (4 bands)	8m	0.45~0.52 (Blue)
		0.52~0.60 (Green)
		0.63~0.69 (Red)
		0.76~0.90 (NIR)

- Successful Launch on May 20, 2004
- Began commercial operation in 2005
- SPOT is Exclusive Worldwide Distributor

Formosat-2 Revisit Capabilities

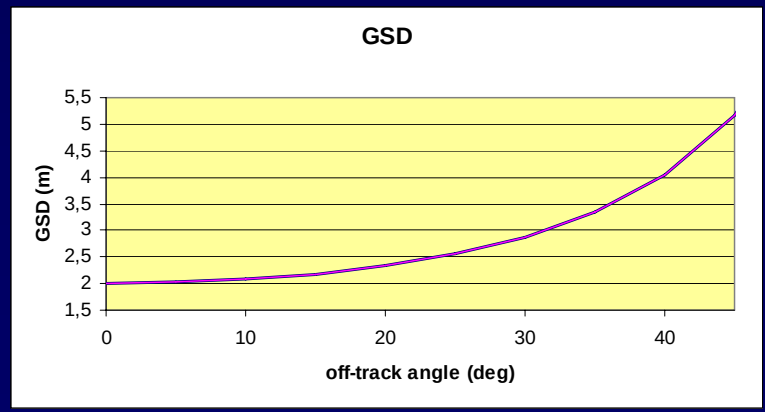


Coverage with +/- 30 ° tilt (GSD < 2.88 m)

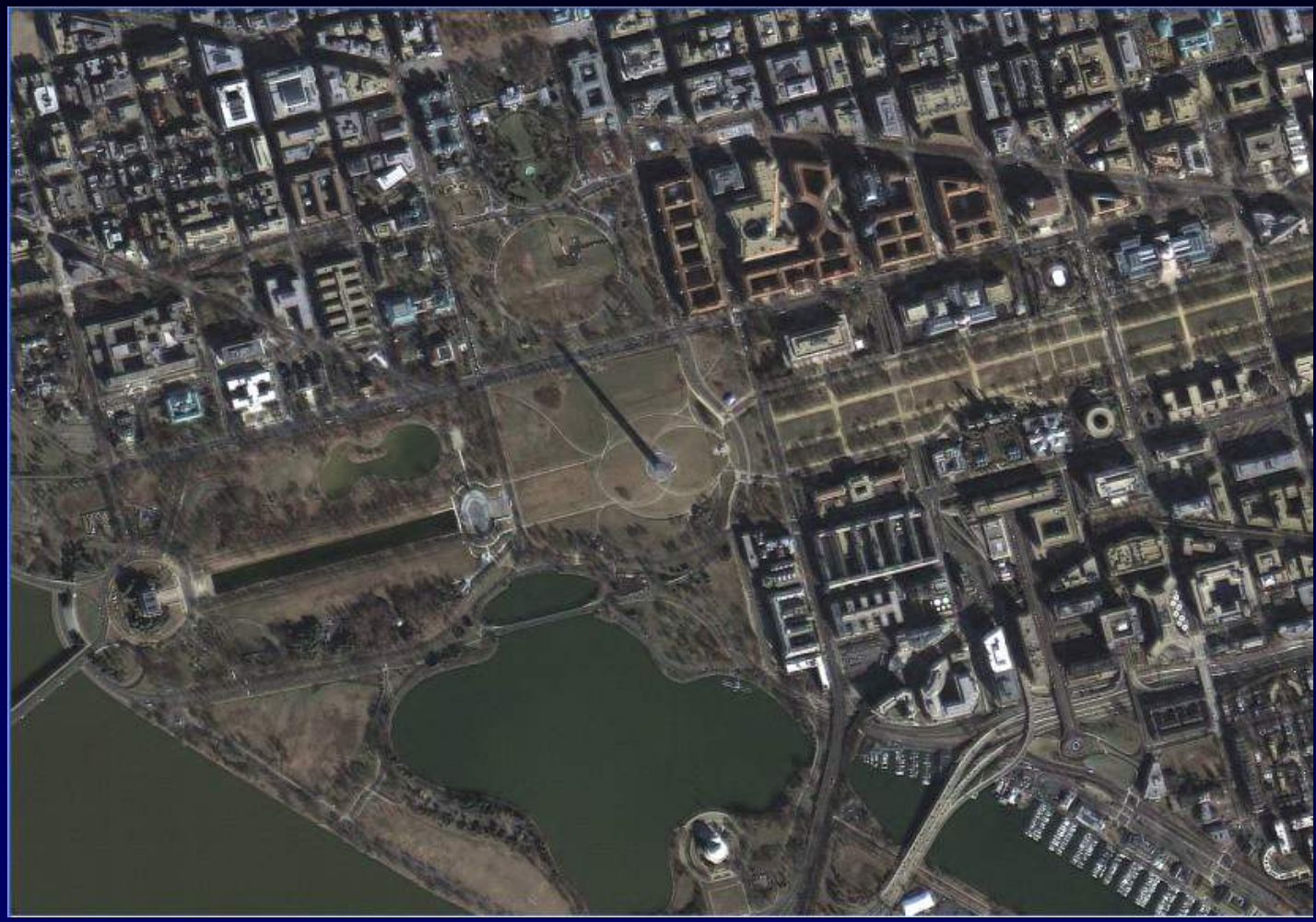


Coverage with +/- 45 ° tilt (GSD < 5.17 m)

- 14 fixed orbits / day
- Consistent daily revisit over the same corridors of visibility
- Design to perform Daily Monitoring
- Recorder, 8 minutes/orbit capability



Harris Evaluation of F2 vs SPOT 5 Data
Washington DC



F2 pan + xs merge, resampled to 2 M

How do I search for archive data?

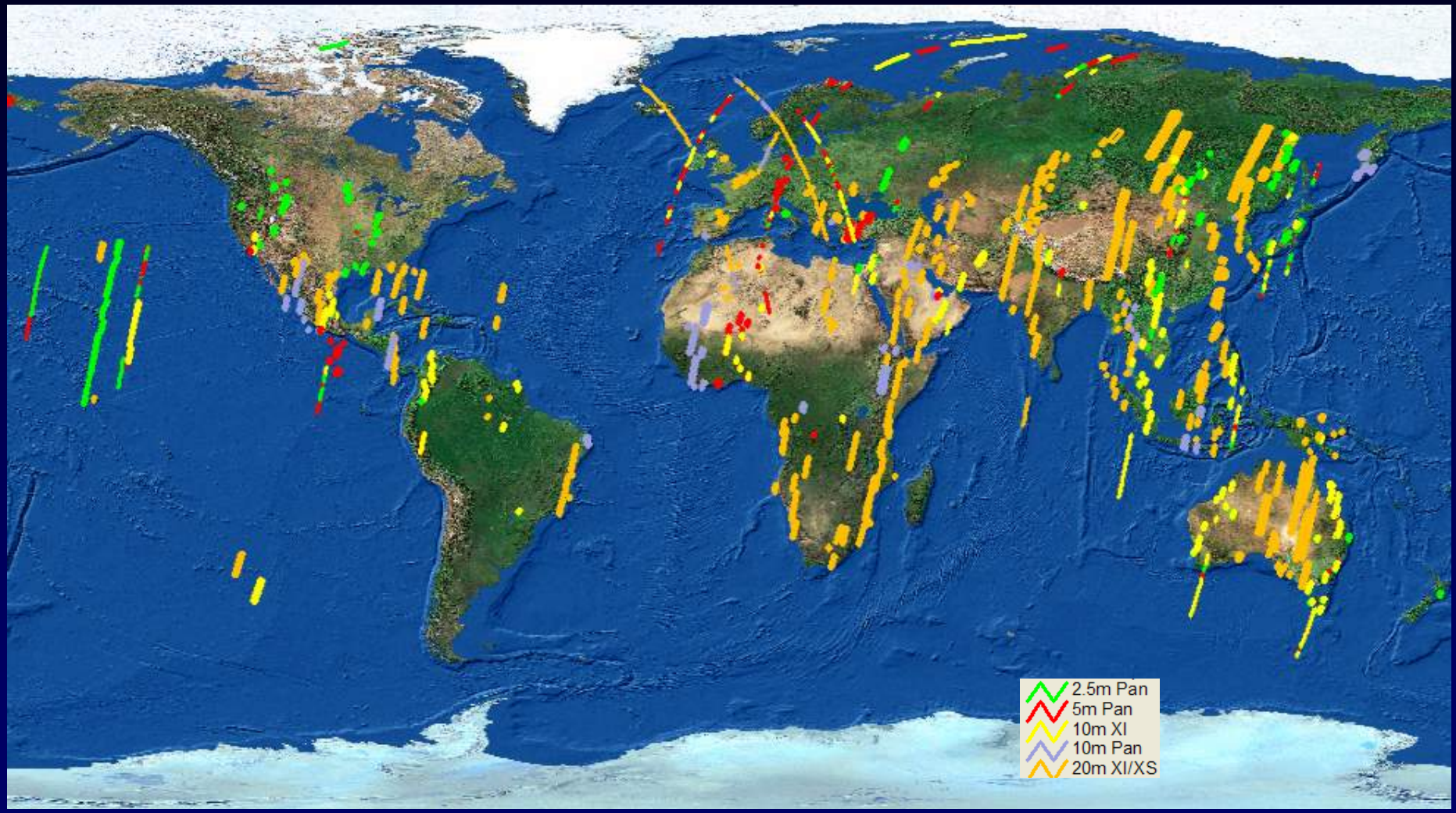
- www.spot.com, select “Online Catalogue”
  - Register & get a user ID and password
  - You now have NIPRNET access to the SIRIUS catalogue. Do archive searches in the privacy & comfort of your own office.
- Call us direct, 703-715-3100. Give us the search parameters and we will return results as you like (.kml files, .jpg views, shape files, stick drawings, Excel, quick-looks).
- We do (almost) 24/7 service for emergencies
- Call NGA Source
- Go to the CSIL via SkyMedia and search for Title 50 holdings of SPOT data
- We are not in the UNIL, because our data is not in NITF format—March 2007, some limited data now?

How do I obtain data?

- Buy from NGA/SPOT Master Contract—Managed via NGA/Source
- Search & download from CSIL
- Download from our .ftp site, if it's licensed for Title 50 and we have it in house
- April 2007—Web based archive for access by defense/intel customers to peruse for Title 50 and single user licensed data.
- If you need sample data to evaluate for any project under consideration-just ask!

SPOT IMAGE
Our Mission: Maintain a Robust Archive

A day of SPOT Collection

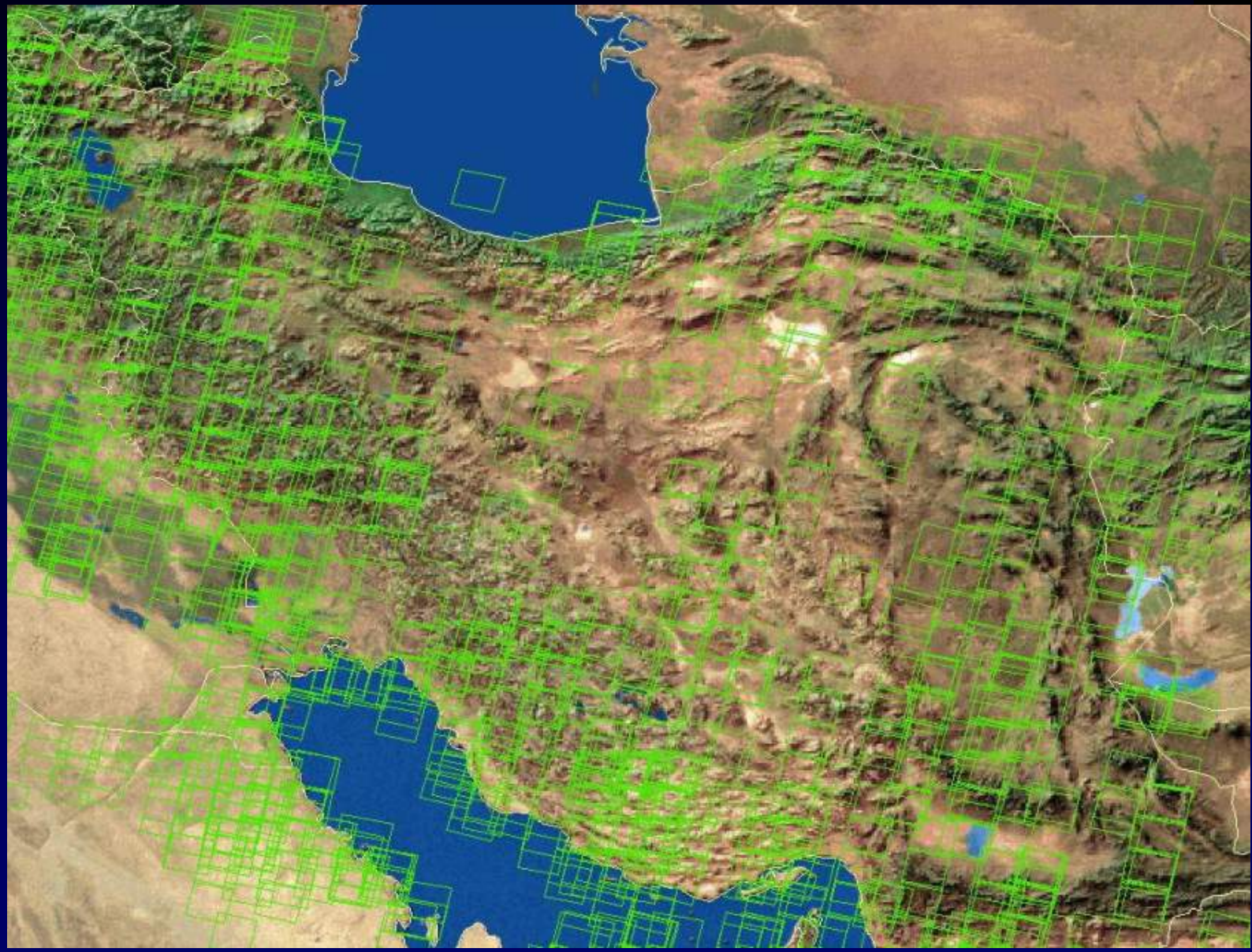


SPOT 5 Operational Goal—Continuous Operations
Collect & Maintain the Most Robust Archive Possible

SPOT 2.5m Panchromatic - Less than 10% Cloud Cover

January-December 2006

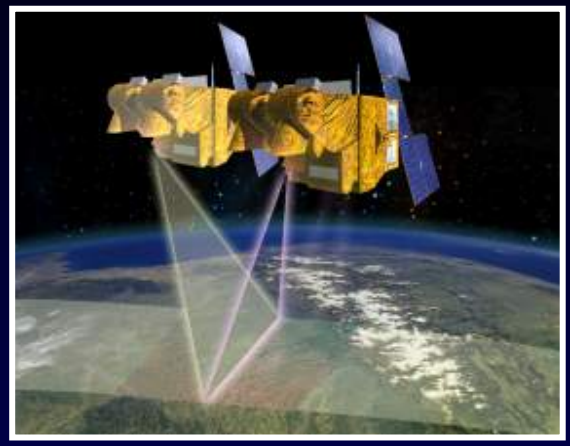
IRAN 2.5 M Panchromatic
January-December 2006
10% or less cloud cover



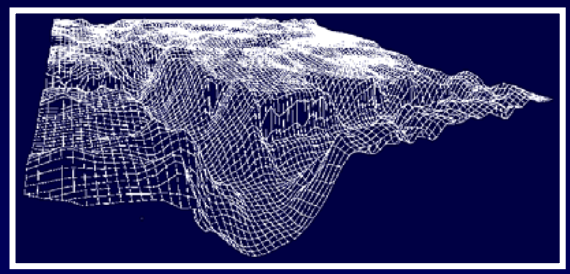
SPOT
IMAGE
Reference3D
Commercial DTED2 Offering

Reference3D – Program Overview

- Unique commercial DTED program
- No equivalent in the commercial market place
- HRS instrument co-funded by SPOT Image and French government



- Dedicated Stereo Sensor (HRS)
- Wide area “Along-Track” stereo-pair collect, 120 by 600 KM strips
- All processing done without the use of ground control points (GCPs)



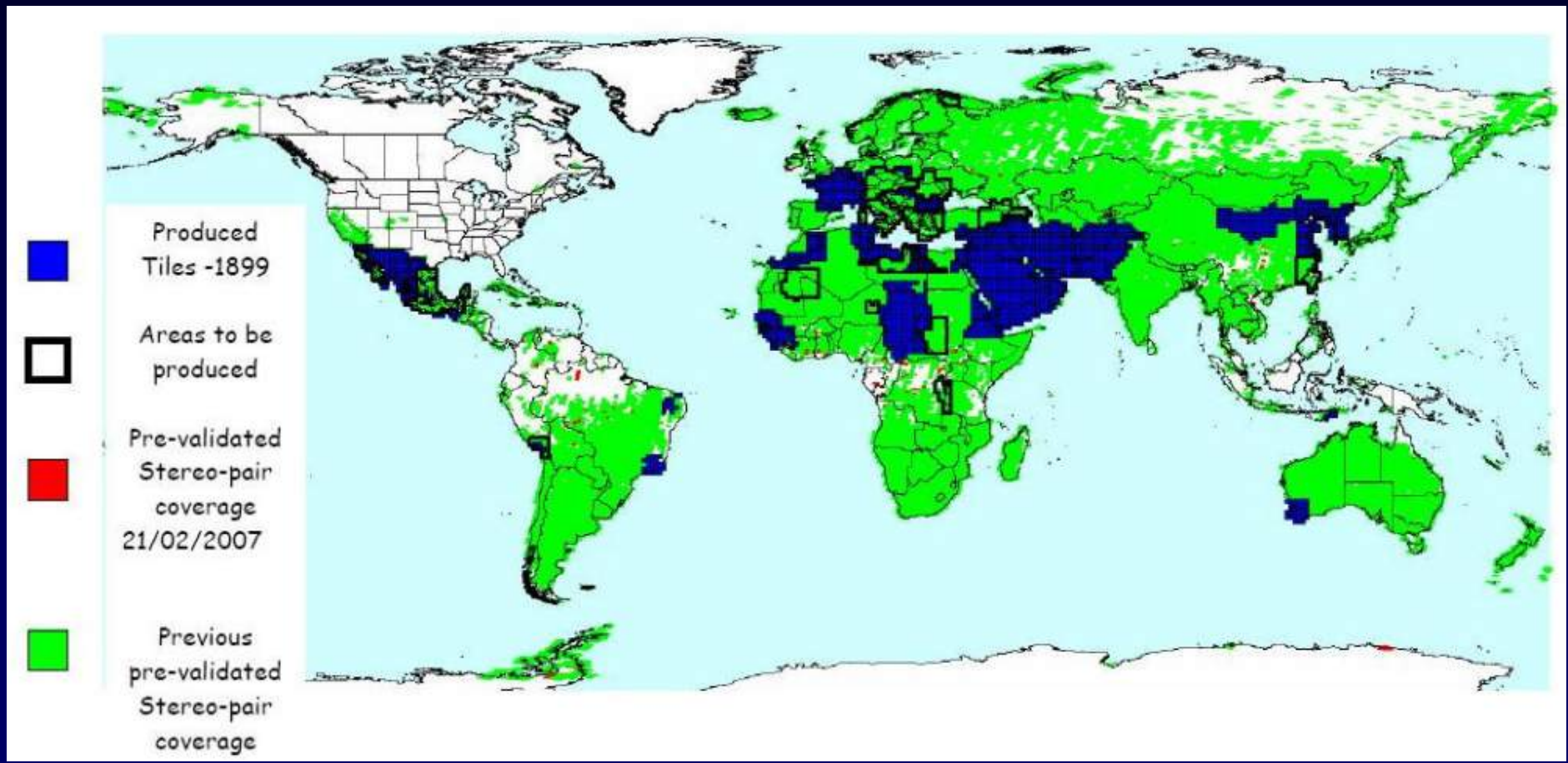
- Absolute horizontal accuracy 15 M CE90
- Absolute vertical accuracy 10-30 M LE90
- Meets NGA DTED level 2 specifications
- Dedicated SPOT Image/IGN production line
- 5 year collection plan, will renewed in 2008 for 5+
- Focused on large area collection

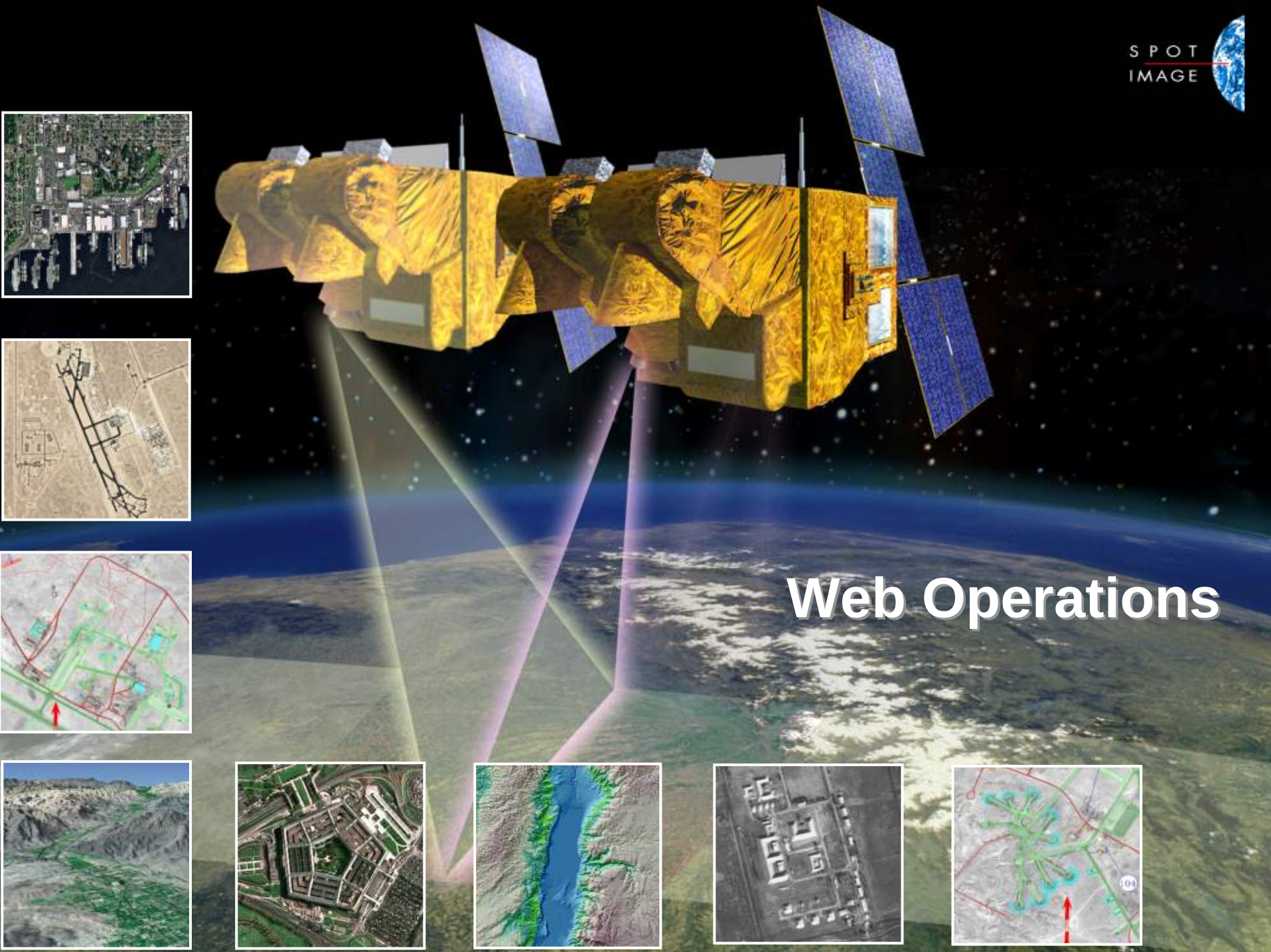
- Expected 30M+ km² (2002-07), additional 70M km² during next 5 years (2008-13)

Reference3D and Data Archive

Status as of March 2007

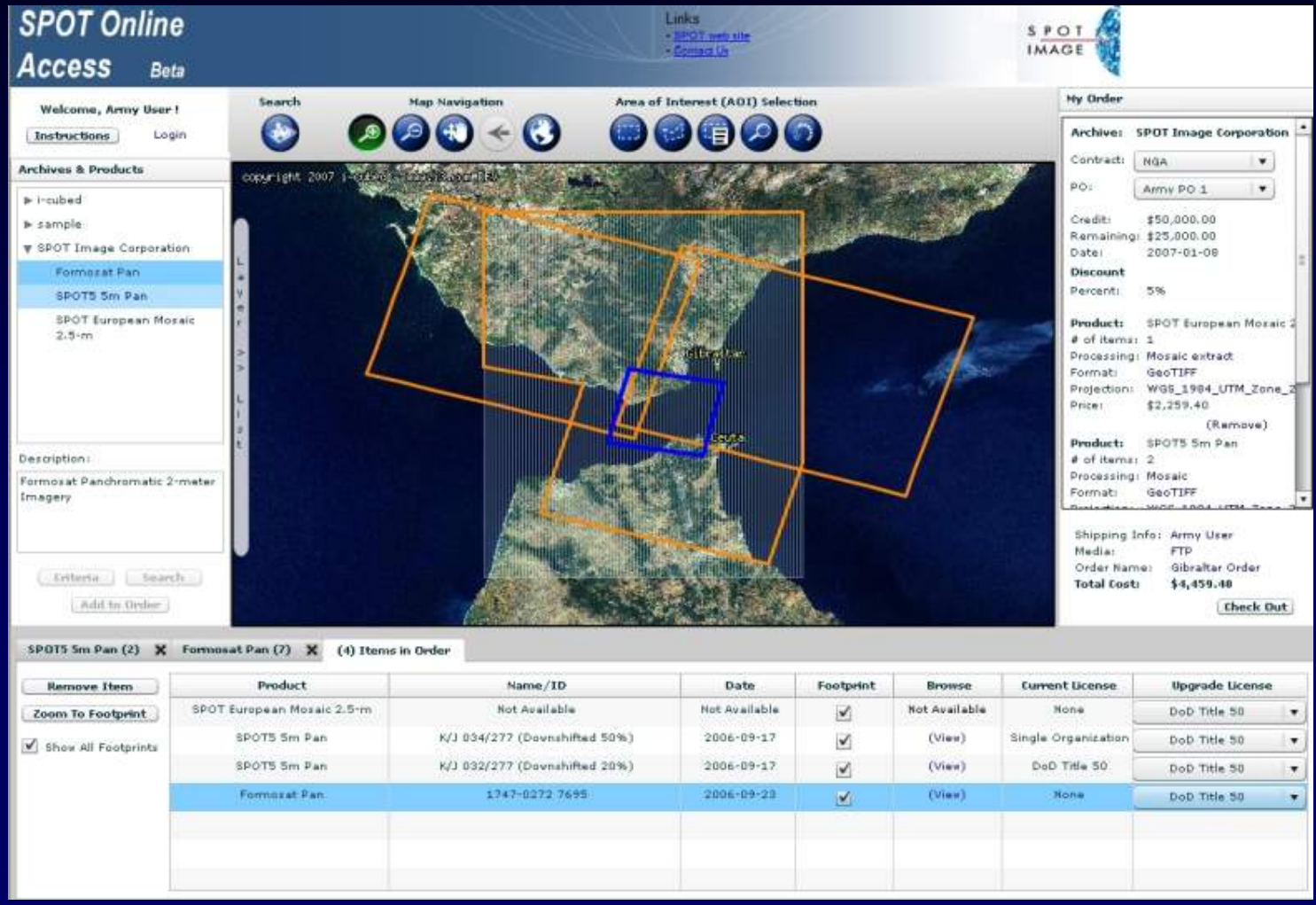
Reference3D Produced Off-the-shelf GeoCells	1,899
Validated HRS Stereo Pair Area Coverage	105,972,268 km²




SPOT
IMAGE
Web Operations

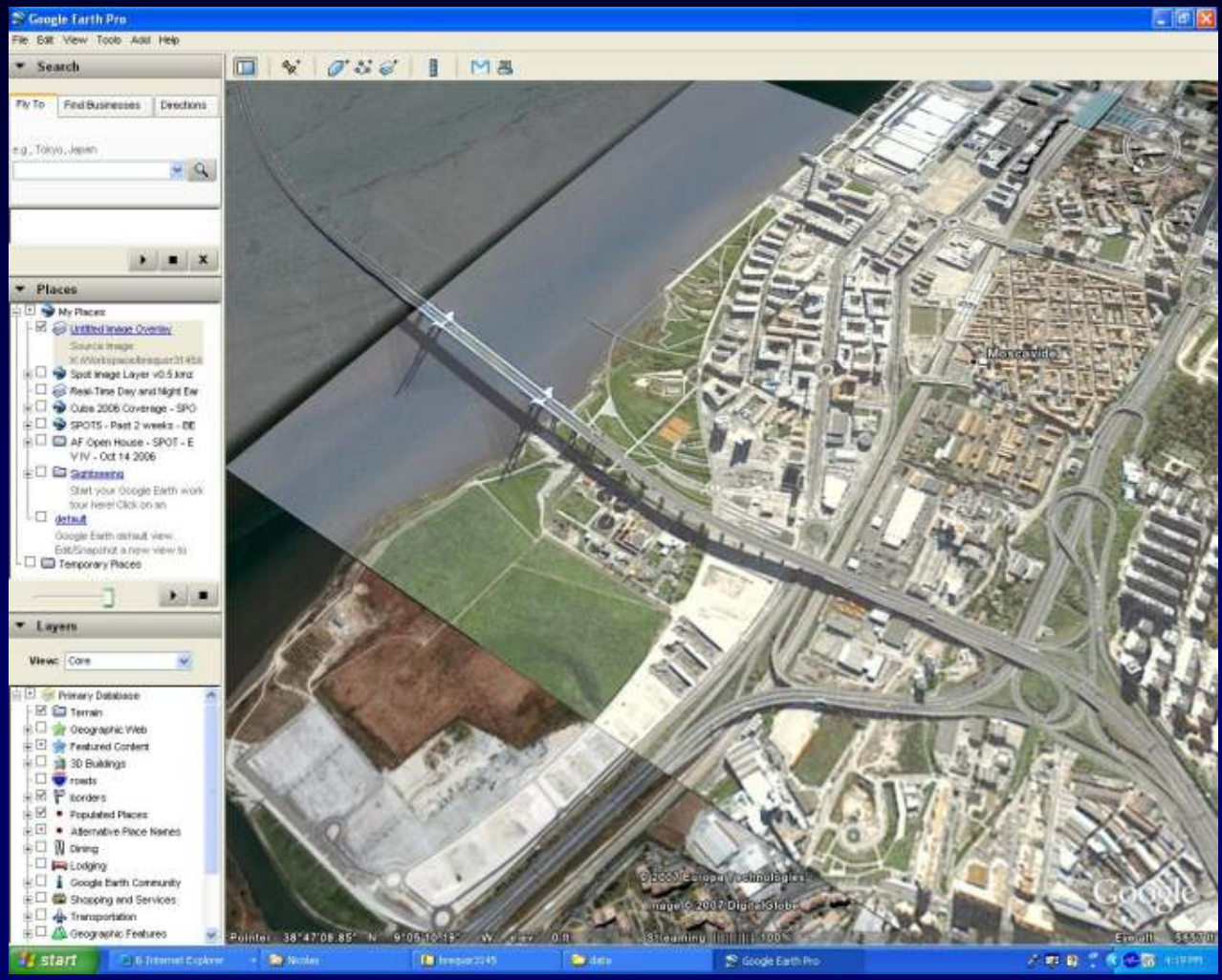
Services

- **SPOT Online Access, operational April 2007**



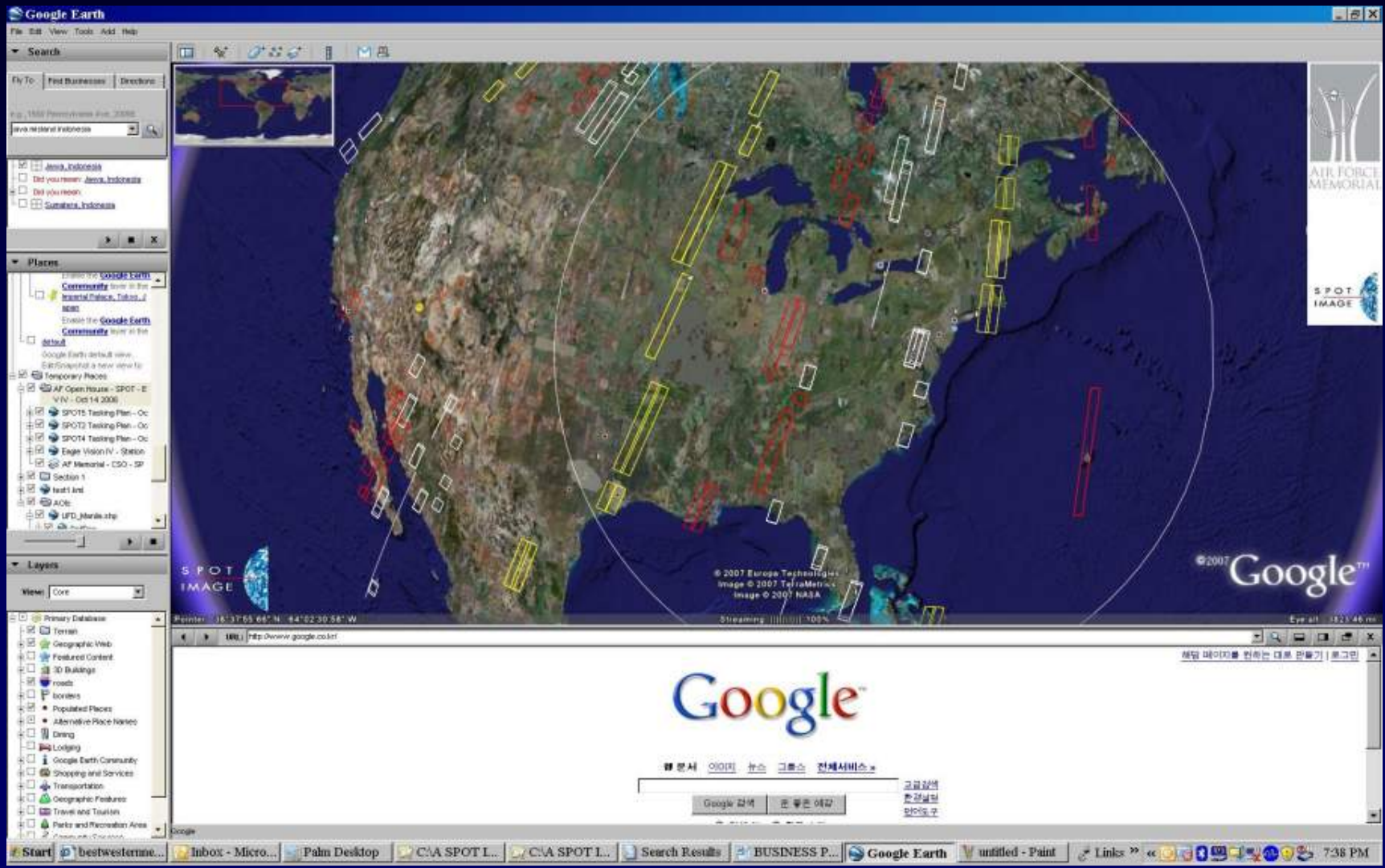
Services (Continued)

- **Incorporating new Google technology for a richer user experience**



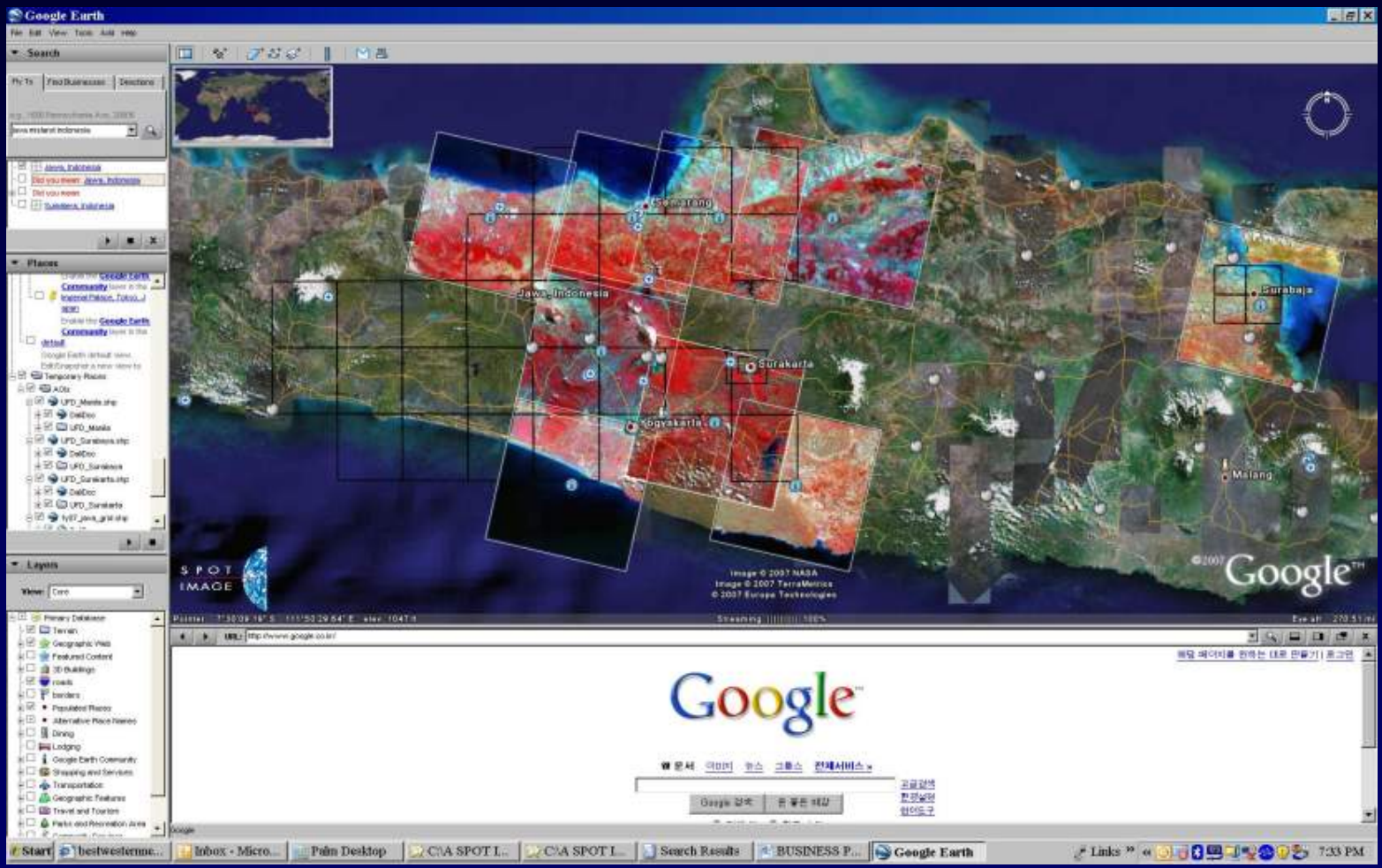
Services (Continued)

- Google .kml/kmz encapsulated files for display and decision support



Services (Continued)

- Google .kml files for archive data search and portrayal of results in a valid context



What Are the Bottom Lines?

- Medium resolution, yet very broad area coverage
- Active satellite operations, 365 days/year. Archive brimming with current data.
- Ongoing 1 arc-second DEM production program
- Access to non-US remote sensing satellite data (SPOT plus others)
- Comparable in some respects to Landsat data
  - Yes—Multispectral, near IR band, panchromatic, large footprint, continuous operation, large archive
  - No—Smaller footprint than TM, fewer MS bands, more expensive, higher resolution, pointable, higher repeat rate over a given target

THANKS!