

# LANDSAT

Presentation for OLLI program  
R808 The Practical Uses of  
Space

“The History, Politics, and  
Technology of the Landsat  
Program”

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Sept 17th '13

# Landsat is Important

- NASA's Landsat program virtually invented the multispectral imaging system that is used by all the world for land use imaging/change monitoring
- Landsat 8, the current on-orbit system, is the only system that is programmed to image all the global land mass all the time.
- The data are available free to all

# Landsat History

- The Earth photography taken by the Mercury and Gemini astronauts convinced the Director of the U.S. Geological Survey that satellite imagery would be of great value in measuring and understanding our planet's natural resources.
- Thus in 1966 the director Dr. William Pecora convinced the Secretary of the Interior to announce that the DOI was going to launch their own Earth observation satellite.
- That did it. NASA immediately proposed ERTS/Landsat

# And Then

- The Bureau of the Budget immediately argued that high-altitude aircraft would be the fiscally responsible choice for Earth remote sensing
  - They apparently had no interest in a US monitoring of the whole Earth
- The DoD feared a civilian program would compromise the secrecy of their reconnaissance program
- There were also geopolitical concerns about photographing foreign countries without their consent

# And then

- But NASA having already started a program of developing and testing remote sensors on aircraft flights, persevered.
- Finally in 1970 NASA was given the Earth Resources Technology Program (ERTS)
  - 3 satellites
  - 2 sensors
    - A 3 color camera (RBV)
    - A multispectral scanner (MSS)
- The RBV was the prime instrument until the data came in
  - The MSS multispectral data changed the whole concept of remote sensing

# And Then

- Pres Carter transferred Landsat operations to NOAA in 1979 and recommended transition to the private sector
- In 1985 NOAA selected the Earth Observation Satellite Company (EOSAT) a partnership of Hughes and RCA, to operate Landsat for 10 years and sell the data.
- EOSAT priced the data at 400 + dollars and sold virtually no scenes
- Finally, Congress recognized the value of Landsat and in Oct of 1992 passed the Land Remote Sensing Policy Act authorizing Landsat 7 and assuring the continued availability of Landsat images.

# CHRONOLOGY

Landsat 1 (originally named Earth Resources Technology Satellite 1): launched July 23, 1972, terminated operations January 6, 1978

- Landsat 2: launched January 22, 1975, terminated January 22, 1981
- Landsat 3: launched March 5, 1978, terminated March 31, 1983
- Landsat 4: launched July 16, 1982, terminated 1993
- Landsat 5: launched March 1, 1984, recently decommissioned.[10]

# Chronology

- Landsat 6: launched October 5, 1993, failed to reach orbit
- Landsat 7: launched April 15, 1999, still functioning, but with faulty scan line corrector (May 2003) [11]
- Landsat 8: Landsat Data Continuity Mission was launched February 11, 2013.[12] May 30, 2013 Landsat Data Continuity Mission was turned over to USGS and renamed Landsat 8



# Landsat Missions Timeline

QuickTime™ and a  
decompressor  
are needed to see this picture.

# ERTS

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# LANDSAT 7

QuickTime™ and a  
decompressor  
are needed to see this picture.

QuickTime™ and a  
decompressor  
are needed to see this picture.

# Landsat 8

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are needed to see this picture.

# LANDSAT ORBIT

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# Landsat 8 Bands

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# Multispectral Data

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# Multispectral Image Analysis

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# Multispectral Analysis

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# OPTICAL HIGH MULTISPECTRAL RESOLUTION SYSTEMS

## • Table

SATELLITE	COUNTRY	LAUNCH	PAN RES. M	MS RES. M	SWATH KM
<b>GeoEye-1</b>	<i>US</i>	10/15/07	<b>0.4</b>	1.64	15
<b>WorldView -2</b>	<i>US</i>	07/01/08	<b>0.5</b>	1.8	16
<b>QuickBird-2</b>	<i>US</i>	10/18/01	<b>0.6</b>	2.5	16
<b>EROS C</b>	<i>Israel</i>	03/21/08	<b>0.7</b>	2.5	16
<b>Pleiades-1</b>	<i>France</i>	03/01/10	<b>0.7</b>	2.8	20
<b>Pleiades-2</b>	<i>France</i>	03/01/11	<b>0.7</b>	2.8	20
<b>Resurs DK-1 (01-N5)</b>	<i>Russia</i>	06/15/06	<b>1.0</b>	3	28
<b>KOMSAT-3</b>	<i>Korea</i>	11/01/09	<b>0.7</b>	3.2	?
<b>IKONOS-2</b>	<i>US</i>	09/24/99	<b>1.0</b>	4	11
<b>KOMPSAT-2</b>	<i>Korea</i>	07/28/06	<b>1.0</b>	4	15
<b>TopSat (SSTL)</b>	<i>UK</i>	10/27/05	<b>2.5</b>	5	10, 15
<b>Venus</b>	<i>Israel/France</i>	08/01/08		5.3	28
<b>IRS ResourceSat-1 LIS</b>	<i>India</i>	10/17/03	<b>6.0</b>	6	24
<b>IRS ResourceSat-1 LIS</b>	<i>India</i>	12/15/08	<b>6.0</b>	6	24
<b>ARGO</b>	<i>Taiwan</i>	07/01/09		6.5	78
<b>SumbandilaSat</b>	<i>South Africa</i>	08/15/07		7.5	?
<b>RocSat2</b>	<i>Taiwan</i>	04/20/04	<b>2.0</b>	8	24
<b>EO-1</b>	<i>US</i>	11/21/00	<b>10.0</b>	30	37
<b>ALOS</b>	<i>Japan</i>	01/24/06	<b>2.5</b>	10	70
<b>X-Sat</b>	<i>Singapore</i>	04/16/08		10	50
<b>Hi-res Sterio Imaging</b>	<i>China</i>	07/01/08	<b>2.5, 5</b>	10	?
<b>Alsat-2A</b>	<i>Algeria</i>	12/01/08	<b>2.5</b>	10	?
<b>Alsat-2B</b>	<i>Algeria</i>	12/01/09	<b>2.5</b>	10	?
<b>EnMap</b>	<i>Germany</i>	07/01/11		30 Hyp	30
<b>TERRA (ASTER) VNIR</b>	<i>Japan/US</i>	12/15/99		15	60
<b>TERRA (ASTER) SWIR</b>	<i>Japan/US</i>	12/15/99		30	60
<b>TERRA (ASTER) TIR</b>	<i>Japan/US</i>	12/15/99		90	60
<b>THOES</b>	<i>Thailand</i>	10/30/07	<b>2.0</b>	15	90

# Very High Resolution

- Table THE VERY HIGH RESOLUTION SYSTEMS

OPTICAL					
SATELLITE	COUNTRY	LAUNCH	PAN RES. M	MS RES. M	SWATH KM
<b>GeoEye-1</b>	<i>US</i>	10/15/07	<b>0.4</b>	<b>1.64</b>	<b>15</b>
<b>WorldView -1</b>	<i>US</i>	09/18/07	<b>0.5</b>		<b>16</b>
<b>WorldView -2</b>	<i>US</i>	07/01/08	<b>0.5</b>	<b>1.8</b>	<b>16</b>
<b>QuickBird-2</b>	<i>US</i>	10/18/01	<b>0.6</b>	<b>2.5</b>	<b>16</b>
<b>EROS B1</b>	<i>Israel</i>	04/25/06	<b>0.7</b>		<b>7</b>
<b>EROS C</b>	<i>Israel</i>	03/21/08	<b>0.7</b>	<b>2.5</b>	<b>16</b>
<b>KOMSAT-3</b>	<i>Korea</i>	11/01/09	<b>0.7</b>	<b>3.2</b>	<b>?</b>
<b>Pleiades-1</b>	<i>France</i>	03/01/10	<b>0.7</b>	<b>2.8</b>	<b>20</b>
<b>Pleiades-2</b>	<i>France</i>	03/01/11	<b>0.7</b>	<b>2.8</b>	<b>20</b>
<b>IKONOS-2</b>	<i>US</i>	09/24/99	<b>1.0</b>	<b>4</b>	<b>11</b>
<b>Resurs DK-1 (01-N5)</b>	<i>Russia</i>	06/15/06	<b>1.0</b>	<b>3</b>	<b>28</b>
<b>KOMPSAT-2</b>	<i>Korea</i>	07/28/06	<b>1.0</b>	<b>4</b>	<b>15</b>
<b>IRS Cartosat 2</b>	<i>India</i>	01/10/17	<b>1.0</b>		<b>10</b>
<b>EROS A1</b>	<i>Israel</i>	12/05/00	<b>1.8</b>		<b>14</b>
<b>RocSat2</b>	<i>Taiwan</i>	04/20/04	<b>2.0</b>	<b>8</b>	<b>24</b>
<b>THOES</b>	<i>Thailand</i>	10/30/07	<b>2.0</b>	<b>15</b>	<b>22, 90</b>
<b>SPOT-5</b>	<i>France</i>	05/04/02	<b>2.5</b>	<b>10</b>	<b>?, 120</b>
<b>IRS Cartosat 1</b>	<i>India</i>	05/04/05	<b>2.5</b>		<b>30</b>
<b>TopSat (SSTL)</b>	<i>UK</i>	10/27/05	<b>2.5</b>	<b>5</b>	<b>10, 15</b>
<b>ALOS</b>	<i>Japan</i>	01/24/06	<b>2.5</b>	<b>10</b>	<b>35, 70</b>
<b>RazakSat*</b>	<i>Malaysia</i>	01/15/08	<b>2.5</b>	<b>5</b>	<b>?</b>
<b>Alsat-2A</b>	<i>Algeria</i>	12/01/08	<b>2.5</b>	<b>10</b>	<b>?</b>
<b>DMC NigeriaSat</b>	<i>Nigeria</i>	07/01/09	<b>2.5</b>	<b>5, 32</b>	<b>?, 320</b>
<b>Alsat-2B</b>	<i>Algeria</i>	12/01/09	<b>2.5</b>	<b>10</b>	<b>?</b>
<b>SeoSat</b>	<i>Spain</i>	07/01/10	<b>2.5</b>		<b>?</b>
RADAR					
SATELLITE	COUNTRY	LAUNCH	EST RES. M	BAND	
<b><u>COSMO-Skymed-1</u></b>	<i>Italy</i>	06/08/07	<b>1.0</b>	<b>X</b>	
<b><u>TerraSAR X</u></b>	<i>Germany</i>	07/15/07	<b>1.0</b>	<b>X</b>	
<b><u>COSMO-Skymed-2</u></b>	<i>Italy</i>	12/15/07	<b>1.0</b>	<b>X</b>	
<b><u>COSMO-Skymed-3</u></b>	<i>Italy</i>	07/01/08	<b>1.0</b>	<b>X</b>	
<b><u>TerraSAR L</u></b>	<i>Germany</i>	08/15/08	<b>1.0</b>	<b>L</b>	
<b><u>COSMO-Skymed-4</u></b>	<i>Italy</i>	03/01/09	<b>1.0</b>	<b>X</b>	
<b><u>TanDem-X</u></b>	<i>Germany</i>	06/30/09	<b>1.0</b>	<b>X</b>	
<b><u>RadarSat 2</u></b>	<i>Canada</i>	10/15/07	<b>3.0</b>	<b>X</b>	
<b><u>RISAT</u></b>	<i>India</i>	12/01/07	<b>3.0</b>	<b>C</b>	
<b><u>KompSat 5</u></b>	<i>S Korea</i>	03/15/10	<b>3.0</b>	<b>X</b>	

# Radar Land Imaging Satellites

SATELLITE	COUNTRY	LAUNCH	BEST RES. M	BAND
<u>ERS-2</u>	ESA	04/21/95	30.0	C
<u>RadarSat 1</u>	Canada	11/04/95	8.5	C
<u>ENVISAT</u>	ESA	03/01/02	30.0	C
<u>ALOS</u>	Japan	01/24/06	10.0	L
<u>Remote Sensing Sat-1</u>	China	04/25/06	?	?
<u>Remote Sensing Sat-2</u>	China	05/25/07	?	?
<u>COSMO-Skymed-1</u>	Italy	06/08/07	1.0	X
<u>TerraSAR X</u>	Germany	07/15/07	1.0	X
<u>RadarSat 2</u>	Canada	10/15/07	3.0	X
<u>RISAT</u>	India	12/01/07	3.0	C
<u>HJ-1C</u>	China	12/15/07	?	S
<u>COSMO-Skymed-2</u>	Italy	12/15/07	1.0	X
<u>SAOCOM-1A</u>	Argentina	07/01/08	10.0	L
<u>COSMO-Skymed-3</u>	Italy	07/01/08	1.0	X
<u>TerraSAR L</u>	Germany	08/15/08	1.0	L
<u>COSMO-Skymed-4</u>	Italy	03/01/09	1.0	X
<u>TanDem-X</u>	Germany	06/30/09	1.0	X
<u>SAOCOM-1B</u>	Argentina	07/01/09	10.0	L
<u>KompSat 5</u>	S Korea	03/15/10	3.0	X
<u>Radarsat Constellation-1</u>	Canada	07/01/11	?	C
<u>Sentinel 1</u>	ESA	07/01/11	5.0	C
<u>Radarsat Constellation-2</u>	Canada	07/01/12	?	C
<u>Radarsat Constellation-3</u>	Canada	07/01/13	?	C

## NUMBER OF RADAR SATELLITES IN ( YEAR'S END

