

High-res. Satellite Imagery

This product survey provides the main characteristics of today's high-resolution imagery acquired from orbiting platforms and suited for mapping purposes. The survey includes both passive optical and active radar sensors.

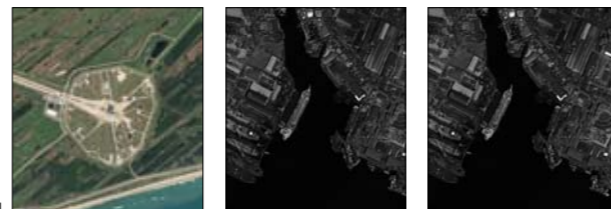
All satellites listed give global coverage and all producers themselves deliver products to customers, while most also make use of a global dealer network, the only exceptions being ImageSat and Kompsat 2. Kompsat 2, also referred to by South Korea as Arirang-2, was developed by KARI (Korea Aerospace Research Institute) to continue the KOMPSAT-1 mission observation programme. The quality of satellite images depends on the level of post-processing. Before delivering imagery to the customer all providers carry out corrections on radiometry and geometry distortions introduced by the sensor system itself. However, the geometrical quality of satellite imagery depends largely upon the use of additional information, in particular Ground Control Points (GCP) and Digital Elevation Models (DEM). Most providers deliver products at several levels of accuracy: raw, geo-referenced (using GCP) and ortho-rectified imagery, using DEM. Of course, the quality of GCPs and DEM used will affect the final quality of satellite imagery and products derived from it.

One system included the survey is still under development, WorldView-2. It is expected that this will be launched in mid-2009. Operating at an altitude of 770km, it will have an average revisit time of once per day and be capable of collecting up to 975,000km² per day of half-metre panchromatic resolution and 1.8-metre multi-spectral resolution. SpotImage did not provide feedback on its products. But descriptions of SPOT 5/HRV, SPOT 5/HRG, SPOT 4/HRV and Formosat-2 may be found in the Product Survey published in GIM April 2006. GeoEye is represented here by Ikonos. For the features of OrbView-2 and OrbView-3, the reader is again referred to GIM April 2006. In the same columns it was announced that GeoEye-1, which will be able to collect images at 0.41-metre panchromatic (black & white) and 1.65-metre multi-spectral resolution, would be launched in 2007; launch is now scheduled for 22nd August 2008.

Mathias Lemmens, editor-in-chief, GIM International

Company	Digital Globe	Digital Globe	Digital Globe
Name of Satellite/Sensor [1]	QuickBird	WorldView-1	WorldView-2
Satellite Features			
Launch date of first/last satellite	October 18, 2001	September 18, 2007	mid-2009
Number of satellites launched/still orbiting	1	1	to be launched
Altitude [km]	450km	496km	770km
Weight [kg]	950kg	2,500kg	2,800kg
Launch Venue	Vandenberg AFB, CA, US	Vandenberg AFB, CA, US	Vandenberg AFB, CA, US
Inclination [degrees]	98	98	98
Local time of passing	10:30am	10:30am	10:30am
Nadir revisit frequency [days]	2-3 days depending on latitude	1.7 days at 1 metre GSD or less	1.1 days at 1 metre GSD or less
Expected life-time [years]	7-10 years	7-10 years	7-10 years
Sensor			
Sensor Arrangement[2]	Linear array	Linear array	Linear array
Intensity range [bits]	11 bits	11 bits	11 bits
Panchromatic (Y[pixel size/bandwidth]/N)[3]	0.61m / 0.445 - 0.9µm	0.5cm / 0.445 - 0.9µm	□
Multispectral (Y[no of bands]/N)[4]	2.4m / 0.45 - 0.52µm; 0.52 - 0.6µm; 0.63 - 0.69µm; 0.76 - 0.9µm	N	□
Pansharpened (Y[pixel size]/N)	0.61m	N	0.46m
Radar (Y[pixel size/bandwidth + polarisation]/N)	N	N	N
Coverage			
Swath Width [km]	16.5km	17.6km	16.4km
Off-nadir Range	□	□	□
Scene size [km x km]	16.5km x 16.5km; strip: 16.5km x 115km	□	□
Stereo (Y[across/in-track]/N)	Across-track	Across-track/in-track	□
Deliverables			
File formats	GeoTIFF 1.0, NITF 2.0/2.1	GeoTIFF 1.0, NITF 2.0/2.1	GeoTIFF 1.0, NITF 2.0/2.1
Deliverable medium[6]	CD/DVD/FTP/WEB	CD/DVD/FTP/WEB	CD/DVD/FTP/WEB
Metric Accuracy (2 sigma) [m]			
Raw image	23m circular, 17m linear	6.5m circular, 6.5m linear	□
Corrected for distortions	□	□	□
Typical Applications (max. 5)	Defence and Intelligence, civil government mapping, energy, internet mapping, navigation.	Defence and Intelligence, civil government mapping, energy, internet mapping, navigation.	Defence and Intelligence, civil government mapping, energy, internet mapping, navigation.
Additions (Max. 30 words)	Support of many diverse applications; first in a constellation that offers highly accurate, commercial high-resolution imagery.	WorldView-1, launched September of 2007, is the most agile satellite ever flown commercially. The high-capacity, panchromatic imaging system features half-metre resolution imagery.	WorldView-2 is scheduled for launch of 2009. Operating at an altitude of 770 kilometres, [7]

N/A = Not Applicable
 □ = No information received



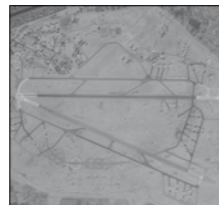
Indian Space Research Organization (ISRO)		ISRO	ISRO	ISRO
IRS-P6 Resourcesat-1		IRS-P5 Cartosat-1	IRS-Cartosat-2	IRS-Cartosat-2A
October 17, 2003		May 5 2005	January 10 2007	April 28 2008
1		1	1	1
817km		618km	637km	637km
1350kg		1560kg	680kg	690kg
Satish Dhawan Space Centre, India		Satish Dhawan Space Centre, India	Satish Dhawan Space Centre, India	Satish Dhawan Space Centre, India
98.69		97.87	97.9	97.9
10:30am		10:30am	09:30am	09:30am
5-24 days		126 days	310 days	310 days
5 years		5 years	5 years	5 years
LISS IV	LISS III	AWiFS	PAN-Fore and PAN-Aft	
Linear array: 2000	Linear array: 6000	2 Linear arrays: 6000	Linear array: 12000	Linear array: 12000
7 bits	7 bits	10 bits	10 bits	10 bits
5.8m / 0.62 - 0.68µm	23.5m / 0.52 - 1.7µm	56m / 0.52 - 1.7µm	2.5m / 0.5 - 0.85µm	1m / 0.5 - 0.85µm
5.8 m / 0.52 - 0.86µm (MX mode)				
3m	4m	4m	N/A	N/A
N	5.8 m (sharpened with LISS-IV Mono Mode) / N	N	N	N
70km mono / 23.9 km MX mode	140km	740km	PAN-Fore 30km / PAN-Aft 27km	9.6km
398km	N/A	N/A	260km	630km
70km x 70km / 23km x 23km	140km x 140km	740km x 740km	27km x 27km	9.6km x 9.6km
N	N	N	In-track (+26° / -5°) (B/H=0,62)	N
GeoTIFF with RPCs, TIFF, Fast Format, Super Structure		GeoTIFF with RPCs, Fast Format	GeoTIFF with RPC	GeoTIFF with RPC
CD, DVD, FTR, HD		CD, DVD, FTR, HD	CD, DVD, FTP	CD, DVD, FTP
N/A			N/A	□
320m (system corrected w/o GCP)			250m (system corrected w/o GCP)	□
Crop monitoring, Forest Monitoring, Mapping, Planning, 3D fly-through products.			DEMs, Mapping, Defence, 3D Terrain Visualisation, 3D fly-through products.	□
Resourcesat-2 will be launched in Q1-2009.			Allows generation of DEMs with up to 4m elevation accuracy.	□





Company	GeoEye	ImageSat	ImageSat	Infoterra GmbH	KARI
Name of Satellite/Sensor[1]	IKONOS	EROS-A	EROS-B	TerraSAR-X	KOMPSAT-2
Satellite Features					
Launch date of first/last satellite	September 24 1999	December 5 2000	April 25 2006	June 15 2007	July 28 2006
Number of satellites launched/still orbiting	3 launched / 2 still in orbit	1	1	1	1
Altitude [km]	681km	510km	510km	514km	685km
Weight [kg]	726kg	250kg	300kg	1230 Launch Mass	800
Launch Venue	Vandenberg AFB, CA, US	Svobodny Russia	Svobodny, Russia	Baikonur Cosmodrome, Kazakhstan	Pletsetsk Cosmodrome, Russia
Inclination [degrees]	98.1	97.2	97.2	97.44	98,13
Local time of passing	10:15am	9:45am	1:45pm	6:00pm	10:50am
Nadir revisit frequency [days]	140 days	9.5 days at 30 deg latitude	9.5 days at 30 deg latitude	11 days	28 days
Expected life-time [years]	11 years	12 years	12 years	5 years	3 years
Sensor					
Sensor Arrangement[2]	linear arrays	linear array	linear array	Active Phased Array Antenna; 287 T/R modules	linear array
Intensity range [bits]	11 bits	10 bits	10 bits	32 bits	10 bits
Panchromatic (Y[pixel size/bandwidth]/N)[3]	1m / 0.526-0.929µm	1.9m / 0.5 - 0.9µm	0.7m / 0.5-0.9µm	N/A	1m / 0.5 - 0.9µm
Multispectral (Y[no of bands]/N)[4]	4m / 0.445 - 0.516µm; 0.506 - 0.595µm; 0.632 - 0.698µm; 0.757 - 0.853µm	N	N	N/A	4m / 4 bands
Pansharpened (Y[pixel size]/N)	1m	N	N	N	1m
Radar (Y[pixel size/bandwidth + polarisation]/N)	N	N	N	various, depending on mode ¹	N
Coverage					
Swath Width [km]	11.3km	14km	7km	5 - 150km	15km
Off-nadir Range	Unlimited	500km	500km	550km	30°
Scene size [km x km]	width: 11km; strip 11 - 1000km	14km x 14km; strip: 14km x 150km	7km x 7km; strip: 7km x 300km	various, depending on mode ²	15km x 15km
Stereo (Y[across/in-track]/N)	in-track	in-track	in-track	N	across-track
Deliverables					
File formats	GeoTIFF, NITF, DEM, DTED	0A; 1A; 1B; 8/16 Bit Tiff (GeoTiff)	0A; 1A; 1B; 8/16 Bit Tiff (GeoTiff)	COSAR, Geotiff (depending on product)	Geo Tiff with RPC file
Deliverable medium[6]	CD-ROM, DVD, hard drive or electronically	CD/FTP/WEB	CD/FTP/WEB	CD, DVD, WEB, FTP, Courier	FTP / CD / DVD
Metric Accuracy (2 sigma) [m]					
Raw image	Not available	≤500m	≤50m	1m absolute for SSC using 20cm science orbit accuracy	80 m
Corrected for distortions	Mono: 8m, Stereo: 8m horizontal & 12m vertical.	□	□	SSC and MGD: 1m ³	80m
Typical Applications (max. 5)	Disaster response & emergency management; security; urban planning & management; exploration & resource development, cartography.	National / homeland security; mapping; infrastructure planning & monitoring; disaster assessment.	National / homeland security; mapping; infrastructure planning & monitoring; disaster assessment.	IMINT, topographic mapping, thematic mapping (urban; agriculture, forestry), defence & security; oil & gas; ocean/sea ice/oil spill monitoring.	Large scale mapping, surveillance and intelligence, civil engineering.
Additions (Max. 30 words)	World's first commercial, high-resolution satellite; directly downlinks to ground stations around the globe; in-track stereo takes two images 1 minute apart on the same orbital pass.	Designed to maximise operator flexibility and the high manoeuvrability of the system enables it to be quickly pointed to image customer-specified sites on Nadir or at oblique angles of up to 45 degrees. Oblique viewing enables recording any site two to three times per week.		In the TanDEM-X mission, 2 satellites of the TerraSAR-X type will be operated for interferometric applications and global DEM generation starting 2009. [8]	KOMPSAT-2 is a new response to fit VHR applications with a huge acquisition capacity available for commercial needs. KOMPSAT-2 offers dedicated feasibility studies, regular progress reporting and, most important, cloud cover not exceeding 10%.

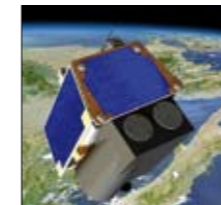
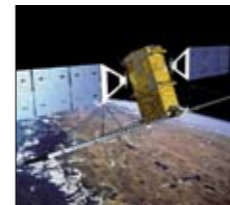
N/A = Not Applicable
□ = No information received



MDA - Geospatial Services	QinetiQ	NASA
RADARSAT-2	TopSat	Terra/ASTER
December 14 2007	October 27 2005	December 18 1999
2 - RADARSAT-1 and -2	1	1
798km	686km	705km
2,200 kg	108kg	5,190kg
Baikonur Cosmodrome, Kazakhstan	Plesetsk Cosmodrome, Russia	Vandenberg AFB, CA, US
98.6 degrees	98deg	98.3
06:00am and 06:00pm	10:30am	10:30am
24 days	3-4 days (Non-Nadir)	16 days (233 orbits)
7-10 years	1 year	5 years
SAR / phased array antenna	2 linear arrays	VNIR (3 bands), SWIR (6 bands), TIR (5 bands) subsystems
8 bits, compressed to 4, 3, 2, or 1 with Block Adaptive Quantification	□	8 VNIR & SWIR, 12 TIR
N/A	2.8m / 0.45-0.7µm	N/A
N/A	5.6m / blue, green, red	VNIR 15m, SWIR 30m, TIR 90m / 0.52 - 11.65µm
N/A	N	N
3 - 100m / 11.6, 17.3, 30, 50, 100MHz; HH, HV, VH, VV	N	N
20km to 500km (10+ Beam Modes available)	12km	60km
250km - 1050km (left and right)	30°	+/- 318 VNIR; +/- 116 SWIR & TIR
20km x 20km to 500km x 500km	panchromatic: 17km x 17km; multi-spectral: 12km x 18km	60km x 60km
N	N	in-track
GeoTIFF	jpeg, tiff, geotiff	HDF-EOS, Geo-Tiff
FTP, CD	CD, FTP	FTP, DVD
100m	□	Not applicable
20m	□	50m
Environmental monitoring and resource mapping, ice reconnaissance, maritime surveillance and disaster management.	Disaster monitoring, change detection.	Land surface climatology and change, ecosystem dynamics, hazard monitoring, hydrology, geology.
RADARSAT-2 provides powerful new capabilities which include high resolution imaging, flexibility in selection of polarization, left and right-looking imaging options, shortened programming, processing and delivery timelines, superior data storage, and more precise measurements of spacecraft position and attitude.	□	ASTER is a co-operative effort between NASA and Japan's Ministry of Economy Trade and Industry (METI), with the collaboration of scientific and industry organisations in both countries.

Footnotes

- High-resolution SpotLight: > 1m, at 150 or 300MHz (reduced swath); Single HH, VV, Dual HH and VV; SpotLight: 2 - 4 m, single HH or VV; dual HH and VV; cross HV/HH, VH/VV; Quadruple polarisation in Advanced Operation Mode StripMap only; 1/2 swath. ScanSAR: 16m, Single HH or VV.
 - High-resolution SpotLight: 10km x 5km; SpotLightL: 10km x 10km, StripMap: 30km x 50km - 1,650km; ScanSAR: 100km x 150km - 1,650km
 - http://www.info.terra.de/fileadmin/Verzeichnisse/Dokumente/3_TerraSAR-x/TX-GS-DD-3302_Basic-Product-Specification-Dokument_1.5.pdf, chapter 3.4
- Notes:
- If the same sensor type has been launched more than once, refer all questions to the most recent one.
 - Identify whether the sensor consists of a single recording element whether they are arranged in a linear array or in an area array.
 - Pixel size is used here equivalent to ground sample distance (GSD) [m]; bandwidth is the range of the electromagnetic band(s) [µm]
 - If Yes, list in addition to the number of bands, per band GSD and bandwidth.
 - Identify part(s) of the globe covered by the satellite.
 - E.g. CD, Internet, ...
 - WorldView-2 will enable DigitalGlobe to offer half-metre panchromatic resolution and 1.8-metre multispectral resolution. WorldView-2 will have an average revisit time of 1 day and will be capable of collecting up to 975,000 square kilometers (376,000 square miles) per day of half-metre imagery.
 - TerraSAR-X will be followed by Terra-X-2. Both missions will generate a global DEM with a height accuracy better than 2m. Regional DEM accuracy will be increased up to 1m. Further information: <http://www.terra-sar.de/>



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RIEGL LMS GmbH, A-3580 Horn, Austria, office@riegl.com.at
RIEGL USA Inc., Orlando, Florida, info@rieglusa.com
RIEGL Japan Ltd., Tokyo, Japan, info@riegl-japan.co.jp

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