

ASPRS GUIDE TO LAND IMAGING SATELLITES

W. E. STONEY

NOBLIS INC. (FORMERLY MITRETEK)

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INTRODUCTION

Purpose

- This report is maintained to assist the federal agencies in planning for future data acquisition programs and to make the broader remote sensing user community aware of just how ubiquitous imaging the Earth from space at mid to hi resolution (56 to 0.4 meters) has become. At the end of 2007:
 - 13 countries had 31 optical systems on orbit (will be 21/51 in '09)
 - 6 countries had 10 radar systems on orbit (will be 10/18 in '11)

Background

- This survey was initiated under MITRE/Mitretek contracts with NASA and the USGS in support of the 1995 ASPRS Satellite Conference. NOAA supported development of a data base web site and an updating in the 2002 period.

Sources

- All of the data are from open sources, all of the systems are defined as civil; the majority of the systems have web sites that contain detailed descriptions of the satellites and their sensors. Googling will find them and locate relevant news items.
- While the system definitions remain constant once announced the launch dates are highly volatile . History has shown that few satellites launch within 6 months of their initial launch date. Many have had a year or more delays.

Data Availability

- Labeling systems "civil" implies that their data will be made available to the public in some fashion. However there is no central source that lists all of the data availability or provides meta data on the scenes that have been acquired. The data obtainable from the commercial satellites are noted on their web sites.

Note

- In comparing systems be aware that the quality of the radiometry is usually not defined and is a variable that may be important for specific uses.
- While the swath widths indicate the area pr orbit viewable by the satellite it does not indicate how much data the satellite can actually acquire. This is a function of the number of ground stations and the size, if any, of the on-board recorder.

Corrections and/or additions will be gratefully accepted

THE CHARTS

- OPTICAL SATELLITES
 - IN LAUNCH ORDER
 - BY COUNTRY
 - BY BEST RESOLUTION
 - BY SWATH (Note, some swaths not known and multiple sensors with different swaths are listed separately)
 - IN-ORBIT GRAPH
 - NUMBER IN ORBIT AT YEAR'S END
- RADAR SATELLITES
 - IN LAUNCH ORDER & BY COUNTRY
 - IN-ORBIT GRAPH
 - NUMBER IN ORBIT AT YEAR'S END
- PLUS
 - RELATIVE SCENE SIZE IMAGE
 - SATELITE BANDS

OPTICAL LAND IMAGING SATELLITES WITH 56 METERS OR BETTER RESOLUTION

BY LAUNCH DATE

SATELLITE	COUNTRY	LAUNCH	PAN RES. M	MS RES. M	SWATH KM
Landsat 5	US	03/01/84		30.0	185
SPOT-2	France	01/22/90	10.0	20	120
IRS 1D	India	09/29/97	6.0	23	70, 142
Proba	ESA	10/21/97		18 Hyp	14
SPOT-4	France	03/24/98	10.0	20	120
Landsat 7	US	04/15/99	15.0	30	185
IKONOS-2	US	09/24/99	1.0	4	11
TERRA (ASTER)	Japan/US	12/15/99		15, 30, 90	60
KOMPSAT-1	Korea	12/20/99	6.6		17
EO-1	US	11/21/00	10.0	30	37
EROS A1	Israel	12/05/00	1.8		14
QuickBird-2	US	10/18/01	0.6	2.5	16
SPOT-5	France	05/04/02	2.5	10	120
DMC AISat-1 (SSTL)	Algeria	11/28/02		32	600
DMC BilSat (SSTL)	Turkey	09/27/03	12.0	26	24, 52
DMC NigeriaSat-1 (SSTL)	Nigeria	09/27/03		32	600
DMC UK (SSTL)	UK	09/27/03		32	600
IRS ResourceSat-1	India	10/17/03	6.0	6, 23, 56	24, 140, 740
CBERS-2	China/Brazil	10/21/03	20.0	20	113
FORMOSAT-2	Taiwan	04/20/04	2.0	8	24
IRS Cartosat 1	India	05/04/05	2.5		30
MONITOR-E -1	Russia	08/26/05	8.0	20	94, 160
Beijing-1 (SSTL)	China	10/27/05	4.0	32	600
TopSat (SSTL)	UK	10/27/05	2.5	5	10, 15
ALOS	Japan	01/24/06	2.5	10	35, 70
EROS B1	Israel	04/25/06	0.7		7
Resurs DK-1 (01-N5)	Russia	06/15/06	1.0	3	28
KOMPSAT-2	Korea	07/28/06	1.0	4	15
IRS Cartosat 2	India	01/10/07	0.8		10
WorldView -1	US	09/18/07	0.5		16
CBERS-2B	China/Brazil	09/19/07	20.0	20	113
THOES	Thailand	02/27/08	2.0	15	22, 90
RazakSat*	Malaysia	03/01/08	2.5	5	?
HJ-1-A	China	04/01/08		30, 100 Hyp	720, 50
HJ-1-B	China	04/01/08		30, 150, 300	720
RapidEye-A	Germany	04/01/08		6.5	78
RapidEye-B	Germany	04/01/08		6.5	78
RapidEye-C	Germany	04/01/08		6.5	78
RapidEye-D	Germany	04/01/08		6.5	78
RapidEye-E	Germany	04/01/08		6.5	78
SumbandilaSat	South Africa	04/01/08		7.5	?
X-Sat	Singapore	04/16/08		10	50
Hi-res Stereo Imaging	China	07/01/08	2.5, 5	10	?
WorldView -2	US	07/01/08	0.5	1.8	16
Venus	Israel/France	08/01/08		10	28
GeoEye-1	US	08/23/08	0.4	1.64	15
DMC Deimos-1	Spain	11/15/08		22	660
DubaiSat-1	UAE	11/15/08	?	?	?
DMC UK-2	UK	11/15/08		22	660
Alsat-2A	Algeria	12/01/08	2.5	10	?
IRS ResourceSat-2	India	12/15/08	6.0	6, 23, 56	24, 140, 740
EROS C	Israel	04/01/09	0.7	2.8	11
CBERS-3	China/Brazil	05/01/09	5.0	20	60, 120
TWSAT	India	07/01/09		35	140
DMC NigeriaSat	Nigeria	07/01/09	2.5	5, 32	320
ARGO	Taiwan	07/01/09		6.5	78
KOMSAT-3	Korea	11/01/09	0.7	3.2	?
Alsat-2B	Algeria	12/01/09	2.5	10	?
Pleiades-1	France	03/01/10	0.7	2.8	20
CBERS-4	China/Brazil	07/01/10	5.0	20	60, 120
SeoSat	Spain	07/01/10	2.5		?
Pleiades-2	France	03/01/11	0.7	2.8	20
EnMap	Germany	07/01/11		30 Hyp	30
LDCM	US	07/01/11	10.0	30	177
SPOT	France	07/01/12	2.0	6	60
Sentinel 2 A	ESA	07/01/12		10, 20, 60	285
Sentinel 2 B	ESA	07/01/13		10, 20, 60	285

Commercial * Near Equatorial Orbit Revised 1/21/08

Note: Read 4/1 = 1st quarter, 7/1 = in that year, 11 & 12s = late in that year

OPTICAL LAND IMAGING SATELLITES WITH 56 METERS OR BETTER RESOLUTION

SATELLITE	COUNTRY	BY COUNTRY			
		LAUNCH	PAN RES. M	MS RES. M	SWATH KM
Landsat 5	US	03/01/84		30.0	185
Landsat 7	US	04/15/99	15.0	30	185
IKONOS-2	US	09/24/99	1.0	4	11
EO-1	US	11/21/00	10.0	30	37
QuickBird-2	US	10/18/01	0.6	2.5	16
WorldView -1	US	09/18/07	0.5		16
WorldView -2	US	07/01/08	0.5	1.8	16
GeoEye-1	US	08/23/08	0.4	1.64	15
LDCM	US	07/01/11	10.0	30	177
DMC UK (SSTL)	UK	09/27/03		32	600
TopSat (SSTL)	UK	10/27/05	2.5	5	10, 15
DMC UK-2	UK	11/15/08		22	660
DubaiSat-1	UAE	11/15/08	?	?	?
DMC BilSat (SSTL)	Turkey	09/27/03	12.0	26	24, 52
THOES	Thailand	2/27/2008	2.0	15	22, 90
FORMOSAT-2	Taiwan	04/20/04	2.0	8	24
ARGO	Taiwan	07/01/09		6.5	78
DMC Delimos-1	Spain	11/15/08		22	660
SeoSat	Spain	07/01/10	2.5		?
SumbandilaSat	South Africa	04/01/08		7.5	?
X-Sat	Singapore	04/16/08		10	50
MONITOR-E -1	Russia	08/26/05	8.0	20	94, 160
Resurs DK-1 (01-N5)	Russia	06/15/06	1.0	3	28
DMC NigeriaSat-1 (SSTL)	Nigeria	09/27/03		32	600
DMC NigeriaSat	Nigeria	07/01/09	2.5	5, 32	320
RazakSat*	Malaysia	03/01/08	2.5	5	?
KOMPSAT-1	Korea	12/20/99	6.6		17
KOMPSAT-2	Korea	07/28/06	1.0	4	15
KOMSAT-3	Korea	11/01/09	0.7	3.2	?
TERRA (ASTER)	Japan/US	12/15/99		15, 30, 90	60
ALOS	Japan	01/24/06	2.5	10	35, 70
Venus	Israel/France	08/01/08		10	28
EROS A1	Israel	12/05/00	1.8		14
EROS B1	Israel	04/25/06	0.7		7
EROS C	Israel	04/01/09	0.7	2.8	11
IRS 1D	India	09/29/97	6.0	23	70, 142
IRS ResourceSat-1	India	10/17/03	6.0	6, 23, 56	24, 140, 740
IRS Cartosat 1	India	05/04/05	2.5		30
IRS Cartosat 2	India	01/10/07	0.8		10
IRS ResourceSat-2	India	12/15/08	6.0	6, 23, 56	24, 140, 740
TWSAT	India	07/01/09		35	140
EnMap	Germany	07/01/11		30 Hyp	30
RapidEye-A	Germany	04/01/08		6.5	78
RapidEye-B	Germany	04/01/08		6.5	78
RapidEye-C	Germany	04/01/08		6.5	78
RapidEye-D	Germany	04/01/08		6.5	78
RapidEye-E	Germany	04/01/08		6.5	78
SPOT-2	France	01/22/90	10.0	20	120
SPOT-4	France	03/24/98	10.0	20	120
SPOT-5	France	05/04/02	2.5	10	120
Pleiades-1	France	03/01/10	0.7	2.8	20
Pleiades-2	France	03/01/11	0.7	2.8	20
SPOT	France	07/01/12	2.0	6	60
Proba	ESA	10/21/97		18 Hyp	14
Sentinel 2 A	ESA	07/01/12		10, 20, 60	285
Sentinel 2 B	ESA	07/01/13		10, 20, 60	285
CBERS-2	China/Brazil	10/21/03	20.0	20	113
CBERS-2B	China/Brazil	09/19/07	20.0	20	113
CBERS-3	China/Brazil	05/01/09	5.0	20	60, 120
CBERS-4	China/Brazil	07/01/10	5.0	20	60, 120
Beijing-1 (SSTL)	China	10/27/05	4.0	32	600
HJ-1-A	China	04/01/08		30, 100 Hyp	720, 50
HJ-1-B	China	04/01/08		30, 150, 300	720
Hi-res Sterio Imaging	China	07/01/08	2.5, 5	10	?
DMC AlSat-1 (SSTL)	Algeria	11/28/02		32	600
Alsat-2A	Algeria	12/01/08	2.5	10	?
Alsat-2B	Algeria	12/01/09	2.5	10	?

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OPTICAL LAND IMAGING SATELLITES BY BEST RESOLUTION

SATELLITE	PAN RES. M	MS RES. M	SWATH KM
GeoEye-1	0.4	1.64	15
WorldView -1	0.5		16
WorldView -2	0.5	1.8	16
QuickBird-2	0.6	2.5	16
EROS B1	0.7		7
EROS C	0.7	2.8	11
KOMSAT-3	0.7	3.2	?
Pleiades-1	0.7	2.8	20
Pleiades-2	0.7	2.8	20
IRS Cartosat 2	0.8		10
IKONOS-2	1.0	4	11
Resurs DK-1 (01-N5)	1.0	3	28
KOMPSAT-2	1.0	4	15
EROS A1	1.8		14
FORMOSAT-2	2.0	8	24
THOES	2.0	15	22, 90
SPOT-6	2.0	6	60
SPOT-5	2.5	10	120
IRS Cartosat 1	2.5		30
TopSat (SSTL)	2.5	5	10, 15
ALOS	2.5	10	35, 70
RazakSat*	2.5	5	?
Alsat-2A	2.5	10	?
DMC NigeriaSat	2.5	5, 32	320
Alsat-2B	2.5	10	?
SeoSat	2.5		?
Hi-res Sterio Imaging	2.5, 5	10	?
Beijing-1 (SSTL)	4.0	32	600
CBERS-3	5.0	20	60, 120
CBERS-4	5.0	20	60, 120
IRS 1D	6.0	23	70, 142
IRS ResourceSat-1	6.0	6, 23, 56	24, 140, 740
IRS ResourceSat-2	6.0	6, 23, 56	24, 140, 740
RapidEye-A		6.5	78
RapidEye-B		6.5	78
RapidEye-C		6.5	78
RapidEye-D		6.5	78
RapidEye-E		6.5	78
ARGO		6.5	78
KOMPSAT-1	6.6		17
SumbandilaSat		7.5	?
MONITOR-E -1	8.0	20	94, 160
SPOT-2	10.0	20	120
SPOT-4	10.0	20	120
EO-1	10.0	30	37
X-Sat		10	50
Venus		10	28
LDCM	10.0	30	177
Sentinel 2 A		10, 20, 60	285
Sentinel 2 B		10, 20, 60	285
DMC BiISat (SSTL)	12.0	26	24, 52
Landsat 7	15.0	30	185
TERRA (ASTER)		15, 30, 90	60
Proba		18 Hyp	14
CBERS-2	20.0	20	113
CBERS-2B	20.0	20	113
DMC Deimos-1		22	660
DMC UK-2		22	660
Landsat 5		30.0	185
HJ-1-A		30, 100 Hyp	720, 50
HJ-1-B		30, 150, 300	720
EnMap		30 Hyp	30
DMC AISat-1 (SSTL)		32	600
DMC NigeriaSat-1 (SSTL)		32	600
DMC UK (SSTL)		32	600
TWSAT		35	140

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Note: Read 4/1 = 1st quarter, 7/1 = in that year, 11 & 12s = late in that year

OPTICAL LAND IMAGING SATELLITES BY BEST MS RESOLUTION

SATELLITE	PAN RES. M	MS RES. M	SWATH KM
GeoEye-1	0.4	1.64	15
WorldView -2	0.5	1.8	16
QuickBird-2	0.6	2.5	16
EROS C	0.7	2.8	11
Pleiades-1	0.7	2.8	20
Pleiades-2	0.7	2.8	20
Resurs DK-1 (01-N5)	1.0	3	28
KOMSAT-3	0.7	3.2	?
IKONOS-2	1.0	4	11
KOMPSAT-2	1.0	4	15
TopSat (SSTL)	2.5	5	10, 15
RazakSat*	2.5	5	?
DMC NigeriaSat	2.5	5, 32	320
IRS ResourceSat-1 (HiRes)	6.0	6	24
IRS ResourceSat-2 (HiRes)	6.0	6	24
SPOT-6	2.0	6	60
RapidEye-A		6.5	78
RapidEye-B		6.5	78
RapidEye-C		6.5	78
RapidEye-D		6.5	78
RapidEye-E		6.5	78
ARGO		6.5	78
SumbandilaSat		7.5	?
FORMOSAT-2	2.0	8	24
SPOT-5	2.5	10	120
ALOS	2.5	10	35, 70
X-Sat		10	50
Hi-res Sterio Imaging	2.5, 5	10	?
Venus		10	28
Alsat-2A	2.5	10	?
Alsat-2B	2.5	10	?
Sentinel 2 A		10, 20, 60	285
Sentinel 2 B		10, 20, 60	285
TERRA (ASTER)		15, 30, 90	60
THOES	2.0	15	22, 90
Proba		18 Hyp	14
SPOT-2	10.0	20	120
SPOT-4	10.0	20	120
CBERS-2	20.0	20	113
MONITOR-E -1	8.0	20	94, 160
CBERS-2B	20.0	20	113
CBERS-3	5.0	20	60, 120
CBERS-4	5.0	20	60, 120
DMC Deimos-1		22	660
DMC UK-2		22	660
IRS 1D		23	142
IRS ResourceSat-1	6.0	23	140
IRS ResourceSat-2	6.0	23	140
DMC BiISat (SSTL)	12.0	26	24, 52
Landsat 5		30	185
Landsat 7	15.0	30	185
EO-1	10.0	30	37
LDCM	10.0	30	177
EnMap		30 Hyp	30
HJ-1-A		30, 100 Hyp	720, 50
HJ-1-B		30, 150, 300	720
DMC AiSat-1 (SSTL)		32	600
DMC NigeriaSat-1 (SSTL)		32	600
DMC UK (SSTL)		32	600
Beijing-1 (SSTL)	4.0	32	600
TWSAT		35	140
IRS ResourceSat-1 (AWIFS)	6.0	56	740
IRS ResourceSat-2 (AWIFS)	6.0	56	740

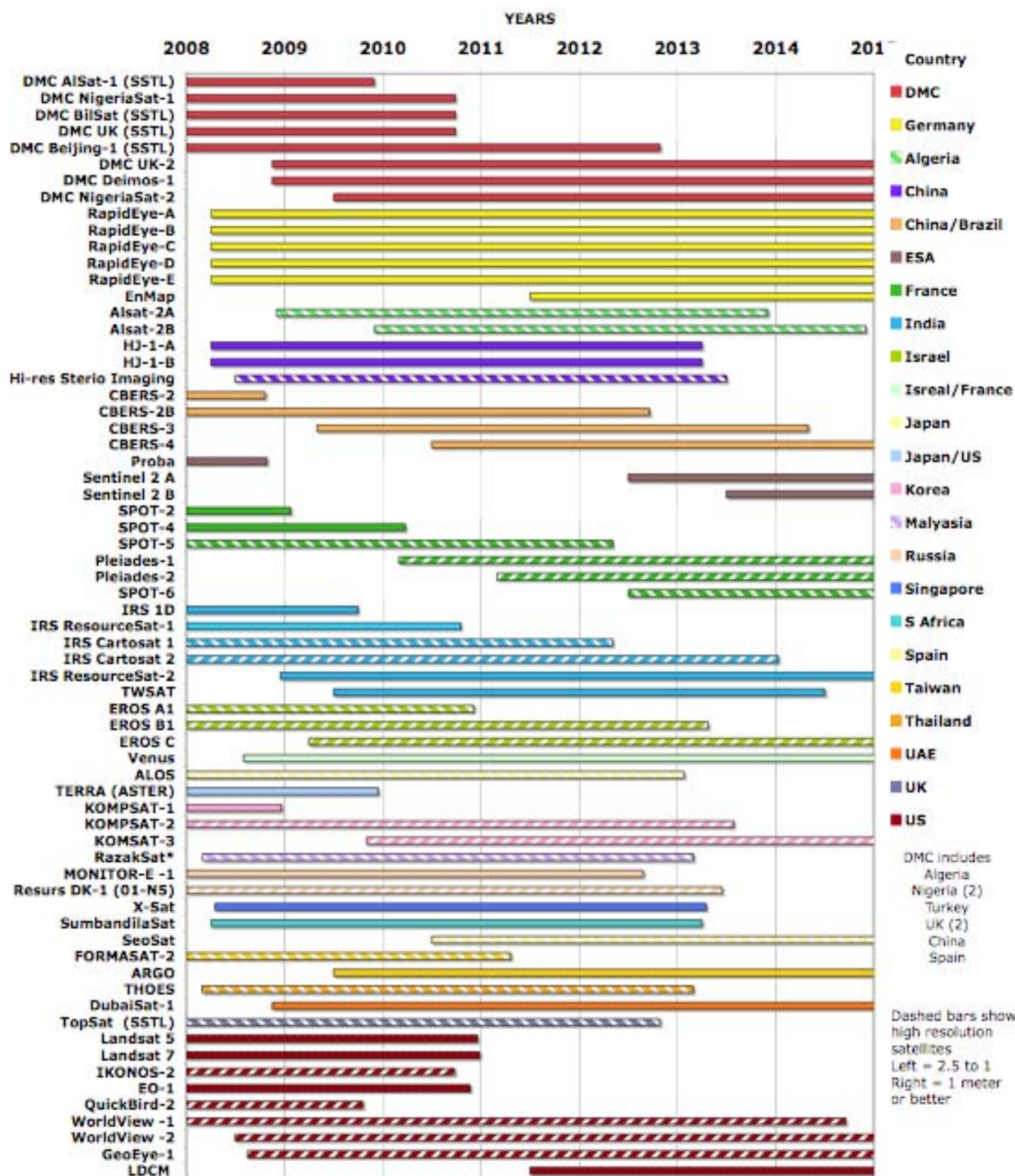
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**OPTICAL LAND IMAGING SATELLITES BY SWATH
LIMITED ANNUAL TOTAL GLOBAL COVERAGE**

SATELLITE	PAN RES. M	MS RES. M	SWATH KM	GLOBAL REPEAT DAYS
EROS B1	0.7		7	429
IRS Cartosat 2	0.8		10	300
TopSat (SSTL)	2.5		10	300
EROS C	0.7	2.0	11	273
IKONOS-2	1.0	4	11	265
Proba		18 Hyp	14	214
EROS A1	1.8		14	214
KOMPSAT-2	1.0	4	15	200
TopSat (SSTL)		5	15	200
GeoEye-1	0.4	1.84	15	197
WorldView -2	0.5	1.8	16	188
QuickBird-2	0.6	2.5	16	188
WorldView -1	0.5		16	188
KOMPSAT-1	6.6		17	176
Pleiades-1	0.7	2.8	20	150
Pleiades-2	0.7	2.8	20	150
THOES	2.0		22	136
FORMOSAT-2	2.0	8	24	125
IRS ResourceSat-1 (LISS-4)	6.0	8	24	125
IRS ResourceSat-2 (LISS-4)	6.0	8	24	125
DMC BIISat (SSTL)	12.0		24	125
Venus		10	28	109
Resurs DK-1 (01-N5)	1.0	3	28	107
EnMap		30 Hyp	30	100
IRS Cartosat 1	2.5		30	100
ALOS	2.5		35	86
EO-1	10.0	30	37	81
X-Sat		10	50	60
HJ-1-A		100 Hyp	50	60
DMC BIISat (SSTL)		26	52	58
SPOT-6	2.0	8	60	50
TERRA (ASTER)		15, 30, 90	60	50
CBERS-4	5.0		60	50
CBERS-3	5.0		60	50
ALOS		10	70	43
IRS 1D (HiRes)	6.0		70	43
RapidEye-A		6.5	78	38
RapidEye-B		6.5	78	38
RapidEye-C		6.5	78	38
RapidEye-D		6.5	78	38
RapidEye-E		6.5	78	38
ARGO		6.5	78	38
THOES		15	90	33
MONITOR-E -1	9.0		94	32
MONTHLY OR BETTER GLOBAL COVERAGE				
CBERS-2	20.0	20	113	27
CBERS-2B	20.0	20	113	27
SPOT-5	2.5	10	120	25
CBERS-3		20	120	25
CBERS-4		20	120	25
SPOT-2	10.0	20	120	25
SPOT-4	10.0	20	120	25
IRS ResourceSat-1(LISS-3)	6.0	23	140	21
IRS ResourceSat-2 (LISS-3)	6.0	23	140	21
TWSAT		35	140	21
IRS 1D		23	142	21
MONITOR-E -1		20	160	19
LDCM	10.0	30	177	17
Landsat 7	15.0	30	185	16
Landsat 5		30.0	185	16
Sentinel 2 A		10, 20, 60	285	11
Sentinel 2 B		10, 20, 60	285	11
DMC NigeriaSat		5, 32	320	9
Beijing-1 (SSTL)	4.0	32	600	5
DMC AiSat-1 (SSTL)		32	600	5
DMC NigeriaSat-1 (SSTL)		32	600	5
DMC UK (SSTL)		32	600	5
DMC Deimos-1		22	680	5
DMC UK-2		22	680	5
HJ-1-A		30	720	4
HJ-1-B		30, 150, 300	720	4
IRS ResourceSat-1 (AWIFS)	6.0	56	740	4
IRS ResourceSat-2 (AWIFS)	6.0	56	740	4

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OPTICAL SATELLITE SCHEDULES



RADAR LAND IMAGING SATELLITES

SATELLITE	COUNTRY	BY DATE		
		LAUNCH	BEST RES. M	BAND
ERS-2	ESA	04/21/95	30.0	C
RadarSat 1	Canada	11/04/95	8.5	C
ENVISAT	ESA	03/01/02	30.0	C
ALOS	Japan	01/24/06	10.0	L
YaoGan WeiXing 1 (JB-5)	China	04/27/06	5.0	L
YaoGan WeiXing 3 (JB-5-02)	China	11/12/07	5.0	L
COSMO-Skymed-1	Italy	06/08/07	1.0	X
TerraSAR X	Germany	07/15/07	1.0	X
RadarSat 2	Canada	09/14/07	3.0	X
COSMO-Skymed-2	Italy	12/08/07	1.0	X
HJ-1C	China	06/15/08	?	S
SAOCOM-1A	Argentina	07/01/08	10.0	L
RISAT	India	07/01/08	3.0	C
COSMO-Skymed-3	Italy	07/01/08	1.0	X
TerraSAR L	Germany	08/15/08	1.0	L
COSMO-Skymed-4	Italy	03/01/09	1.0	X
TanDem-X	Germany	06/30/09	1.0	X
SAOCOM-1B	Argentina	07/01/09	10.0	L
KompSat 5	S Korea	03/15/10	3.0	X
Radarsat Constellation-1	Canada	07/01/11	?	C
Sentinel 1	ESA	07/01/11	5.0	C
SeoSar *	Spain	07/01/11	?	?
Radarsat Constellation-2	Canada	07/01/12	?	C
Radarsat Constellation-3	Canada	07/01/13	?	C

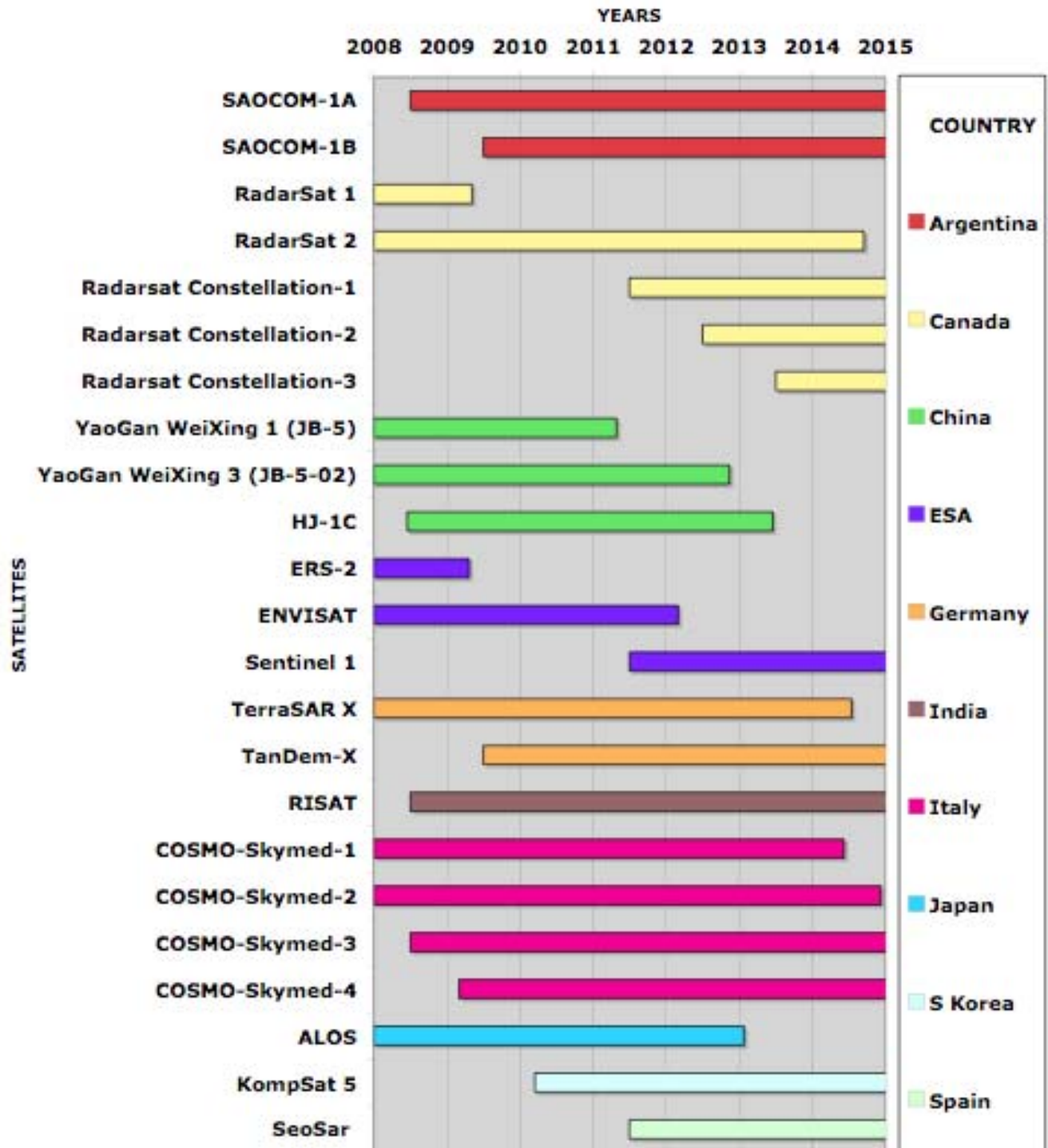
SATELLITE	BY COUNTRY			
	COUNTRY	LAUNCH	BEST RES. M	BAND
SeoSar *	Spain	07/01/11	?	?
KompSat 5	S Korea	03/15/10	3.0	X
ALOS	Japan	01/24/06	10.0	L
COSMO-Skymed-1	Italy	06/08/07	1.0	X
COSMO-Skymed-2	Italy	12/08/07	1.0	X
COSMO-Skymed-3	Italy	07/01/08	1.0	X
COSMO-Skymed-4	Italy	03/01/09	1.0	X
RISAT	India	07/01/08	3.0	C
TerraSAR X	Germany	07/15/07	1.0	X
TerraSAR L	Germany	08/15/08	1.0	L
TanDem-X	Germany	06/30/09	1.0	X
ERS-2	ESA	04/21/95	30.0	C
ENVISAT	ESA	03/01/02	30.0	C
Sentinel 1	ESA	07/01/11	5.0	C
YaoGan WeiXing 1 (JB-5)	China	04/27/06	5.0	L
YaoGan WeiXing 3 (JB-5-02)	China	11/12/07	5.0	L
HJ-1C	China	06/15/08	?	S
RadarSat 1	Canada	11/04/95	8.5	C
RadarSat 2	Canada	09/14/07	3.0	X
Radarsat Constellation-1	Canada	07/01/11	?	C
Radarsat Constellation-2	Canada	07/01/12	?	C
Radarsat Constellation-3	Canada	07/01/13	?	C
SAOCOM-1A	Argentina	07/01/08	10.0	L
SAOCOM-1B	Argentina	07/01/09	10.0	L

* May be operated as part of the German TerraSar-X and TanDem-X constellation

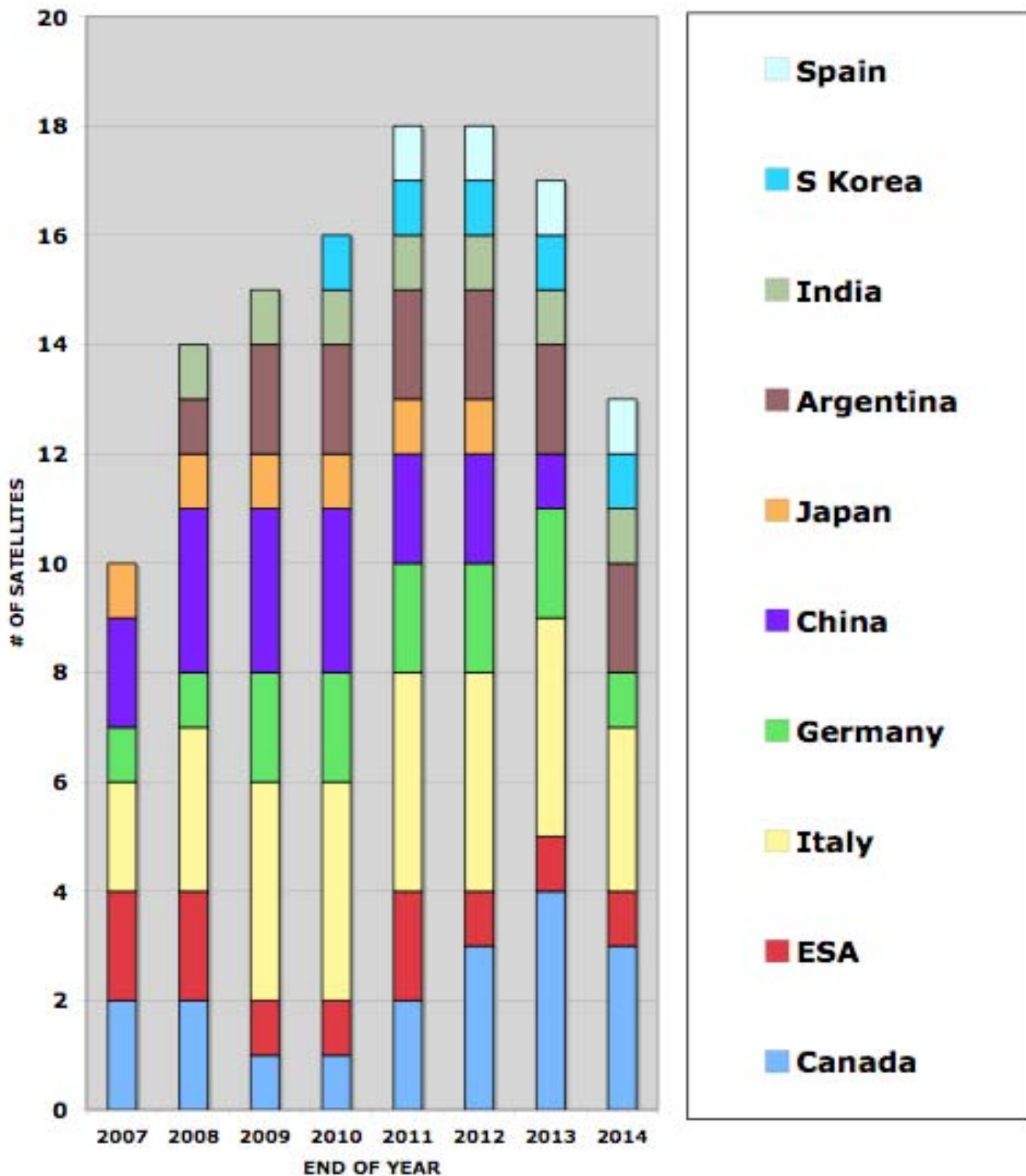
Revised 1/21/08

The Chinese reported the launch of YaoGang WeiXing 2 on 5/27/07 but have left it out of all later notices. Although their many civil uses were advertised the YaoGans may be primarily military

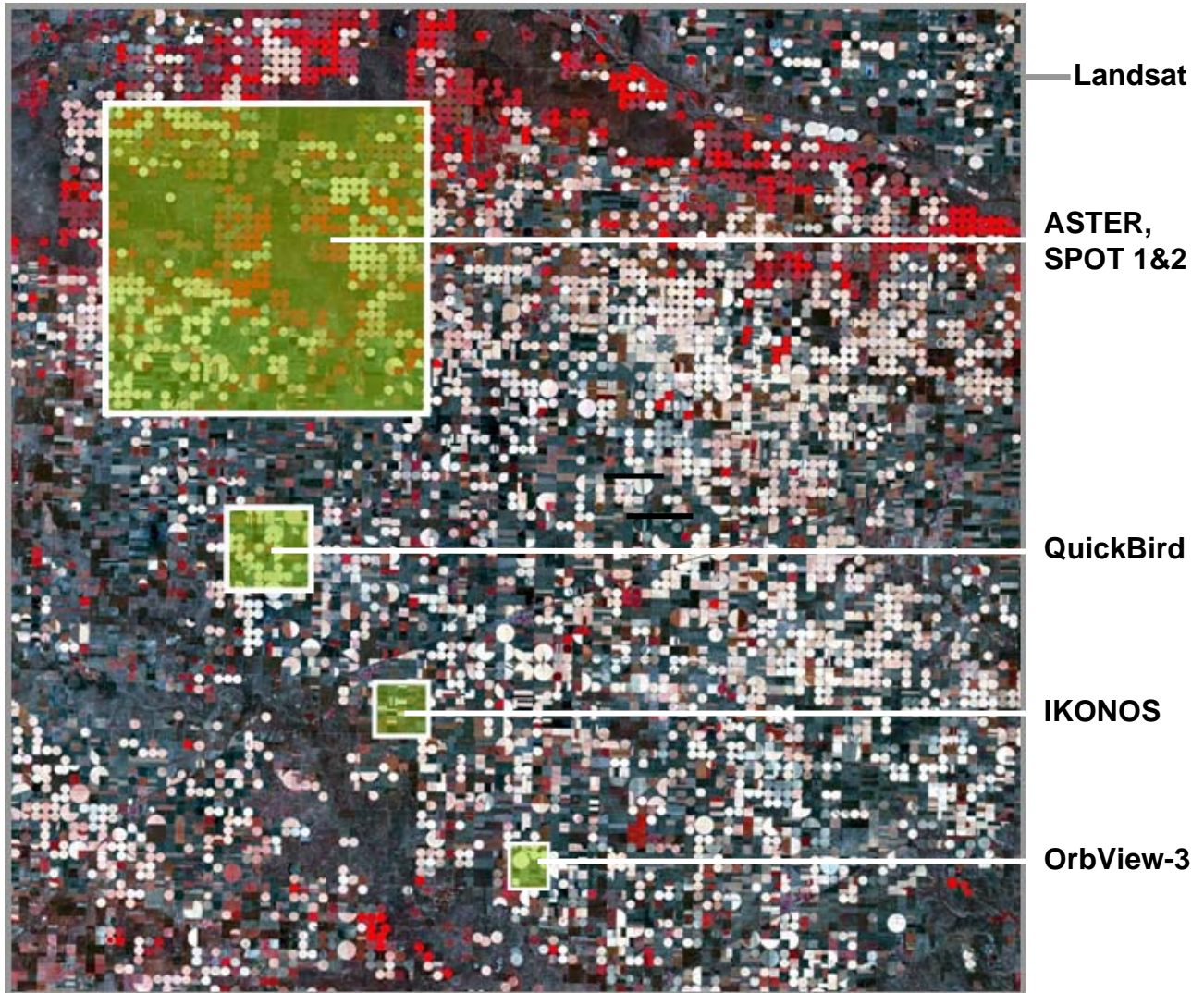
RADAR SATELLITE ON-ORBIT SCHEDULES



ESTIMATED # OF RADAR SATELLITES ON ORBIT



Spatial Coverage



BAND LOCATIONS FOR 30 METER AND BETTER SATELLITES

