

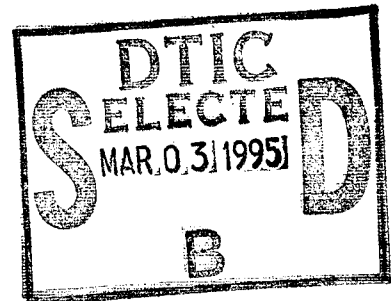
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Final Report  
**RETRIEVAL DISPLAY AND ANALYSIS SUPPORT  
TOOL REQUIREMENTS ANALYSIS**

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October 1994

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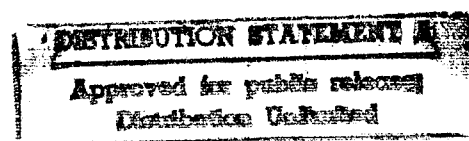
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**1.0 Introduction.** The development of a Retrieval Display & Analysis Support Tool was motivated by the need to provide U.S. Government users of remote sensing with a means of identifying additional sources of data to support their organizational missions. The requirements analysis task involved three sub tasks:

1. Identify users of remote sensing within the U.S. Government.
2. Assess the users' needs within the context of their mission.
3. Characterize the types of data required to support users' needs and provide a means of identifying sensors capable of meeting the user's needs.

The overall objective of RDAST is to develop a prototype tool for assessing the utility of a wide range of sensors for addressing issues of interest to a variety of organizations within the U.S. Government. Given the current situation of tightly constrained federal budgets, expanding information needs, and growing capability of civilian sensors, this tool will provide a means of assessing several important issues.

- Assessing the utility of civilian sensors for tasks currently performed by government operated sensors. (Some tasks may be accomplished using data available from commercial systems. Potentially at a lower cost than from government systems or potentially reducing the burden on government systems. This could in turn reduce the need to procure and operate additional government systems).

- Assessing the utility of government systems to perform new tasks. (Some government systems are not fully tasked. Identifying new applications could permit them to be more fully utilized).

- Assessing the vulnerability of U.S. national security interests to newly operational and developing civilian and foreign sensor systems. New and planned civilian sensors are being developed both in the U.S. and abroad. While most are designed for civilian or commercial purposes, many can potentially provide information of intelligence value to hostile governments.

RDAST is not intended initially to be delivered as a complete database. Rather, the objective is to identify key data requirements and develop a prototype data structure to facilitate selection and sampling of examples of available remotely sensed data and products to permit analysts to assess their potential value.

**2.0 Sources.** This is an unclassified project. The data included in this study all come from open sources. Data on user organizations come from publications by the

organizations themselves or from unclassified directories. A key source for much of this information is the Gale Research Institute.<sup>1</sup>

Data on sensors is all from open source publications, articles and brochures published by the sensor operators.

**2.1 Identifying User Organizations.** Users of remotely sensed data exist throughout the U.S. Government and at many levels. Figure 1 shows the U.S. Government Departments and Agencies identified in this study as containing organizations involved in the use of remotely sensed data.

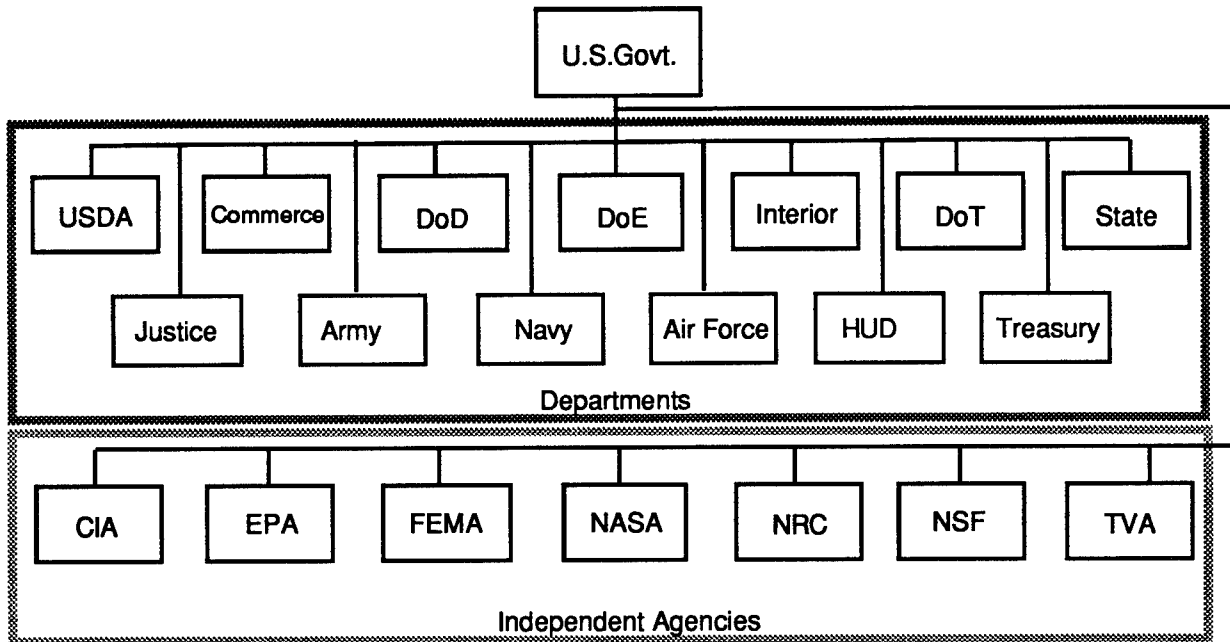


Figure 1. U.S. Government Departments and Agencies

**2.2 Levels of Users.** Users are located at a variety of levels within the U.S. Government. This study focused on the first level at which an organization's primary mission could be identified as one likely to require the use of remotely sensed data. In most cases these organization were found in the third or fourth layer of the government organization as is illustrated in Figure 2.

<sup>1</sup> Government Research Directory, 7th edition, 1993 - 94, Gale Research Inc., Detroit, MI.

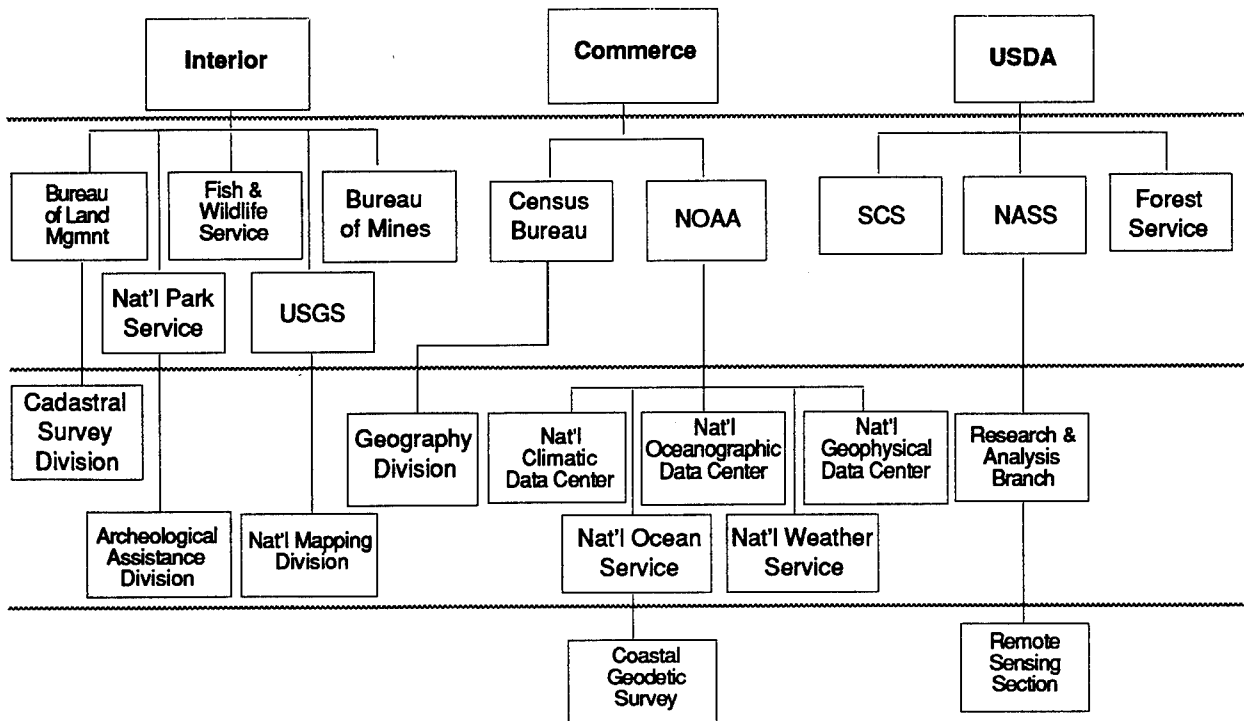


Figure 2. Examples of User Organizations at Various Levels Within the U.S. Government

**2.3 Multiple & Overlapping Missions.** There are also, within the U.S. Government, a number of organizations which perform similar functions. For example; both the Defense Mapping Agency (under DoD) and U.S. Geologic Survey (under Dept. of the Interior) are involved in Topographic Mapping and Charting. They differ in the scope and regions of responsibility. The Tennessee Valley Authority also does mapping within its area of responsibility, as does the Bureau of Land Management. There is also the National Ocean Service's Coastal and Geodetic Survey (under NOAA in the Commerce Dept.), which does coastal mapping in U.S. waters.

Some organizations have multiple missions. For example; both the Defense Department and Central Intelligence Agency are involved in imagery analysis for intelligence purposes, however, differ in area of interest and scope. Figure 3 illustrates a few areas where overlapping missions occur. There are also numerous organizations either involved in or who fund Global Environmental Change research. There are several organizations involved in Polar Studies, but some only in the Arctic (i.e. the U.S. Navy, NRL and NPOC). Both NOAA's U.S. Weather Service and the Air Force Weather Service are engaged in weather prediction.

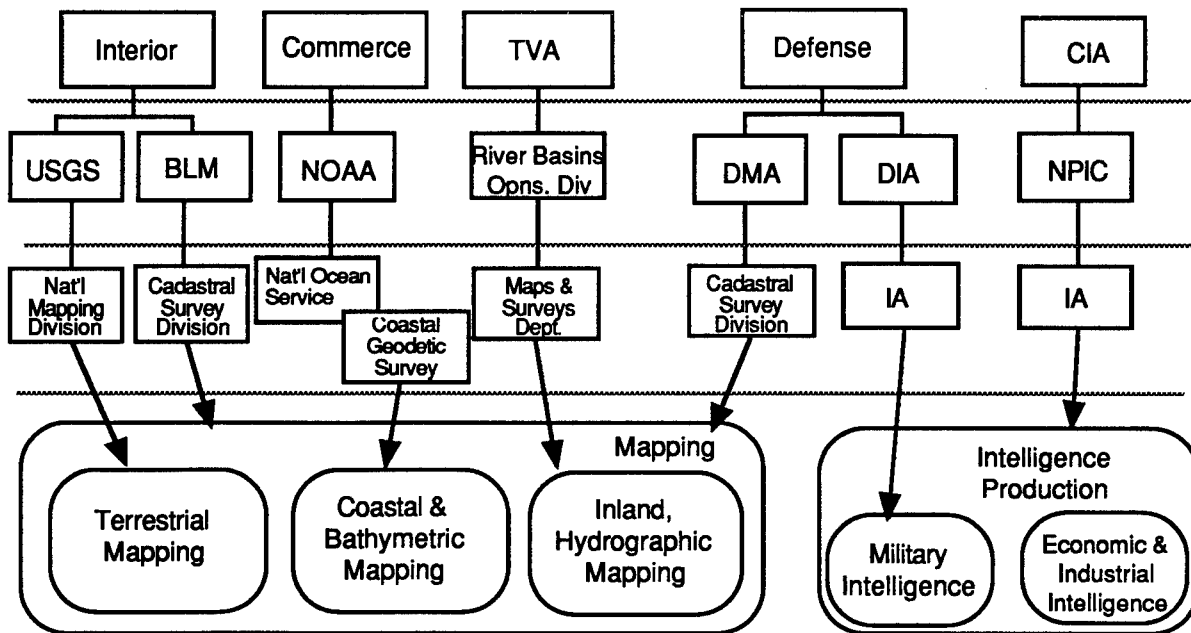


Figure 3. U.S. Government Organizations Performing Similar Missions.

These examples are not meant as a critique of government bureaucracy, nor are they meant to imply that such overlaps should not exist. In most cases there is good reason for the organizations to be performing the missions as they are. Most are focused on specific areas or problems. The fact that many of these organizations are performing similar missions is significant to this study in that it implies that they are engaged in similar analytical tasks and probably require similar data to perform those tasks. This further implies that they might be able to make use of a common suite of sensors.

**3.0 Requirements Analysis Process.** The Requirements Analysis was performed in a four step process:

- Identify Users and their Missions
- Identify the Analytical Tasks required to perform each Mission.
- Identify Information Elements needed to support the Analytical Tasks.
- Identify Data Types required to meet Information needs.

**3.1 Users.** The first step was to produce a file of Users. Unique office codes were assigned to eliminate duplicate names. For example, there is a "Cadastral Survey Division" under both DMA and BLM, Codes assigned were DMA-CSD and BLM-CSD. These names also help trace the office back to its parent branch and department or agency. Because of the multilayered nature of the federal government User's offices were identified down to only three levels. In a few cases offices at a lower level were



identified by simply appending the lower office name. The following data fields were included for each office:<sup>2</sup>

1. Department or Agency
2. Department or Agency Abbreviation
3. Branch
4. Branch Abbreviation
5. Office Name
6. Office Code
7. Mailing Address
8. City
9. State
10. Zip Code
11. Phone Number
12. Mission

**3.2 Missions.** Missions were derived from official mission statements. Due to the unclassified nature of this study, military requirements and intelligence community requirements are expressed in rather generic terms. In some cases the real missions may differ from the stated mission. No attempt was made to correct or even identify discrepancies within this class of users.

One example of where a mission statement has differed from the true mission is the Federal Emergency Management Agency FEMA. FEMA's overt mission was disaster relief and damage assessment. Its real mission was protection of the national command and control system in the event of a nuclear attack. With the end of the Cold War FEMA is now performing in earnest, the mission that once only served as a cover for its real mission.

Some mission statements are quite broad and actually imply multiple missions. Offices with multiple missions were listed multiple times. Missions which lacked any analytical component, such as merely archiving data, were omitted.

**3.3 Analysis Tasks.** The next step was to break down Missions into Analysis Tasks. Analysis Tasks are the primary analytical activity or activities that must be performed in order to carry out the mission. For example; the USGS has a mission of Terrestrial Mapping. This implies several Analysis Tasks:

- Land Use/Land Cover Classification
- Delineation of Water Bodies
- Mapping of Roads and Railroads
- Deriving Topographic Contours

**3.4 Information Elements.** Information elements are key pieces of data required to accomplish an analytical task. Most follow directly from an analysis task. For example; the task of Land Use Classification implies a need for imagery on which, forests, crop

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<sup>2</sup> A printout is included as Appendix D. The file was initially organized as an Excel spreadsheet but is now a FoxPro Database file. Additional fields recommended are; 13. Fax Number, 14. Point of Contact, and 15. Internet/EMail address, (see recommendations).

lands, and urban land can easily be distinguished. A mapping task may further imply a need for geometric accuracy to permit mensuration and accurate geolocations.

**3.5 Data Requirements.** There may be a variety of data types capable of providing a given information element. For example, forest, crop lands, urban areas, water bodies roads and railways are all distinguishable by visual analysis of optical, multispectral or radar imagery, if there is adequate resolution. Some information elements may be met using a variety of analysis techniques. For example; most optical and multispectral systems can produce stereo pairs. Elevation may be derived by for stereo imagery by measuring the parallax at selected points. Radar imagery can also produce terrain elevation by measuring differences in layover or by interferometric techniques.

Figure 4 illustrates some of the multiple relationships which exist between Users, Missions, Analysis Tasks, Information Elements and Sensor Data Types.

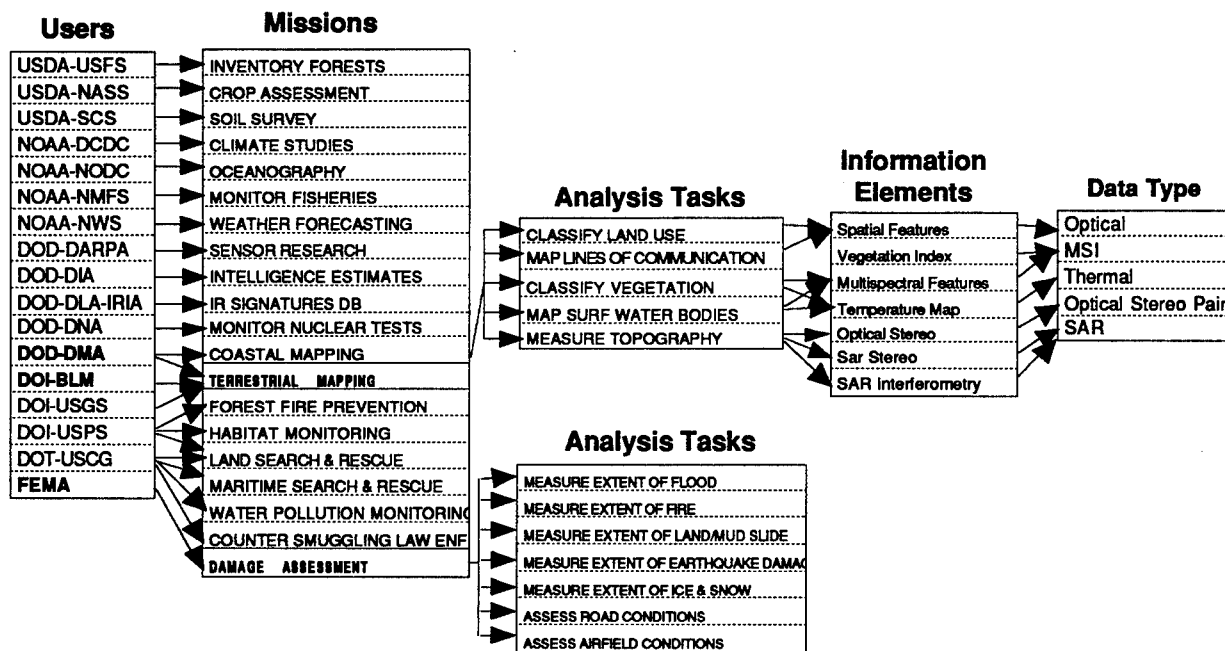


Figure 4. Relationships of Users, Missions, Analysis Tasks & Information Elements

Tables of Users, Missions, Analysis Tasks and Information Elements were developed and linked together in a relational database. This allows one to trace the requirements chain from an individual user office to its information requirements. One could also begin with an information requirement and determine what users share it. Information Elements were not directly linked to specific data types because the actual specification of data requirements is more complicated than a simple linkage.

**4.0 Data Description Criteria.** When a User specifies the data required to perform an Analysis Task, (in support of a Mission), the requirements are usually expressed using some or all of the following criteria:

- **Resolution:** This requirement is driven by the spatial dimensions of the object or phenomena being observed or the sampling dimensions of the data base being

populated. Requirements vary greatly. Ocean phenomena are usually mapped in scaled measured in hundreds of meters, while agricultural assessments typically require resolutions from 30 to 100 meters. Urban planning and mapping requires 10 to 20 meter resolution while many military intelligence tasks require resolution between 30 cm and 10 meters (for B&W panchromatic imagery).

- Extent of Coverage is driven by the total area to be covered and to some extent the time within which an area must be covered.

- Timeliness: Some Missions are more urgent than others and so have different standards for what is an acceptable delay from data collection to analysis, (in some cases hours, days, weeks, or months).

- Periodicity: Surveillance or Monitoring tasks require recurring and sometimes very frequent coverage. Military intelligence tasks demand at least a surge capability of daily or even multiple collections per day. Typical standing requirements are expressed as Daily, 3 Days, Weekly, Monthly, Quarterly, and Annual. High resolution sun-synchronous imaging satellites offer a maximum of one coverage per day with the time over target dictated by the orbit. Military surge requirements imply a need for a constellation of several such satellites. Some tasks require data collected at specific times of year. Topographic mapping is best performed with imagery collected in Fall or Winter when leaves are off the trees.<sup>3</sup>

- Repeatability of Collection Geometries is important for change detection and topography measurement.

- Stereo Tasking is important for topography, terrain analysis, and for many types of detailed intelligence analysis.

- Radiometric Corrections are important for temperature measurements, vegetation classification and change detection.

- Geometric Corrections are important for spatial measurements.

- Georeferencing and Geocoding Capabilities are important for Geographic Information Systems (GIS) applications.

- Existence of and Accessibility of Archives are essential to change detection. Seasonal coverage is also significant for change detection. It is best to compare scenes from the same seasons.

- Legal Restrictions on Use: Security classification or copyrights may limit utility. Releasability to or from foreign governments can be both a benefit and a disadvantage. Many U.S. Government users would be reluctant to rely solely on a foreign sensor unless the supply of data could be guaranteed.

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<sup>3</sup> This is not possible in the Tropics where trees retain their leaves year round. Long term weather patterns can also be significant. Some areas are cloud covered nearly all the time and can only be mapped by radar. Low light conditions and extended periods of cloudy weather also pose problems for optical sensors in the polar regions.

- **Cost:** U.S. Government Users of Government operated sensors tend to view data as an almost 'free good'. The costs are seen most readily in terms of the effort required to collect and exploit the data or in terms of lost opportunities in collecting one set of data at the expense of another. Aside from the agencies which actually operate the sensors, few users have any idea of the dollar cost per scene. The reverse is true for data acquired from sources outside the government.

**5.0 Sensor Description.** One data requirements have been adequately described the next step is to find sensor capable of providing data that meet the information need. Sensor data are described by a set of terminology which while sometimes different from the terms used to state the data requirement are usually analogous enough to permit making a good match between the requirement and sensor.

**5.1 Sensor Characterization.** Sensor data may be characterized by certain image quality and capability measures. These measures differ for different sensor types, as illustrated by Table 1.

Table 1. Sensor Characterization Criteria

	Optical	MSI	Thermal	SAR
<b>Resolution:</b>	Ground Sample Distance (GSD)	Ground Sample Distance (GSD)	Ground Sample Distance (GSD)	Impulse Response IPR
<b>Image Quality:</b>	Interpretability Scale, NIIRS % Cloud Cover	% Cloud Cover	% Cloud Cover	Sidelobe Envelope SNR, Contrast Ratio
<b>Band of Operations:</b>	Band of Operation	Bands of Operation	Band or Bands of Operation &	Center Frequency & Band Width
<b>Sensitivity:</b>	SNR, CR Gamma	NE $\Delta$ p	NE $\Delta$ T	NEP, CR,SNR

Table 1 is not an exhaustive list it only serves to illustrate that while there are analogous characterization criteria for the various sensor types, it is often difficult to compare sensors of different types directly. The abbreviations in this table are defined in Appendix E.

**5.2 Sensor Utility.** Most people have little difficulty understanding the relationship between spatial resolution and the ability of a sensor to provide information. As resolution improves the image looks sharper, more recognizable, and more and more details become apparent. The fact that the benefits of greater spatial resolution is so readily apparent has sometimes led to development of higher resolution systems.

An additional factor which should be considered is the benefit of the information contained in the colors of the visible spectrum and other parts of the electromagnetic

spectrum. Natural color and false color imagery (using the near infrared region) can provide valuable image analysis cues that are often more useful than higher resolution panchromatic imagery. The infrared and microwave regions also contain unique information about the thermal, dielectric and textural properties of a scene. The fact that these properties are not normally perceivable to humans makes data from these sensors harder to understand. It is this same fact that makes these data all the more valuable.

Multispectral Imaging Systems, Synthetic Aperture Radars and Microwave Radiometers are three classes of sensors that produce data sets which contain unique information. In many cases the information is not available directly from the sensor, rather it must be derived through some additional processing of the raw sensor data. Over the years, many processing algorithms and analysis techniques have been developed to derive specific information from these sensors. Numerous band utility studies have been conducted to determine the utility of specific band within the electromagnetic spectrum, (alone or in combination) for deriving certain types of information.

**5.3 Sensor Bands.** Sensors operate within specific of bands within the electromagnetic spectrum. In order to categorize the sensors it is helpful to first categorize the bands over which they operate. For optical and thermal sensors, band placement is dictated to a large degree by the transmission characteristics of the atmosphere. Gases in the atmosphere, (primarily, water vapor, carbon dioxide and ozone), absorb radiation in varying percentages across the spectrum. Where absorption is low, transmission is high, creating "windows" through which remote sensing is possible. Figure 5 illustrates the location of transmission windows and absorption bands.

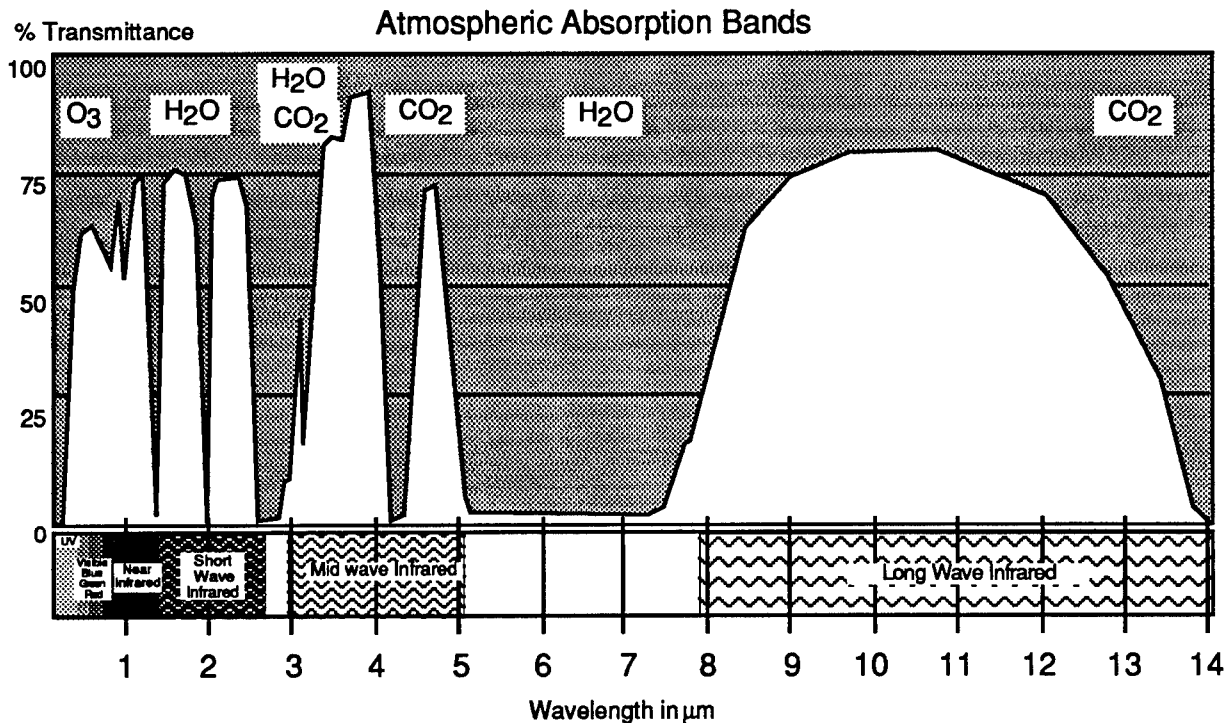


Figure 5. Atmospheric Absorption Bands & Transmission Windows 0 to 14 μm.

While some weather and atmospheric instruments sense in the absorption bands, most sensors focused on the earth's surface have bands positioned to make optimal use of the transmission windows. Table 2 summarizes the bands most commonly employed in multispectral imaging systems.

Table 2. Generic Multispectral Bands

Band Name	Band Width	Remarks
Ultraviolet (UV)	3-400 nm	Reflected EMR. Not visible, largely absorbed in upper atmosphere
Blue	400 - 500 nm	Reflected blue visible light, scattered by atmosphere
Blue-Green	450 - 550 nm	Reflected visible light between blue & green.
Green	500 - 600 nm	Reflected green visible light.
Red	600 - 700 nm	Reflected red visible light.
Near Infrared (NIR)	700 - 1100 nm	Reflected infrared light, not visible to the eye.
Shortwave Infrared	1550 - 2550 nm	A mixture of reflected and emitted EMR, not visible to the eye.
Mid wave Infrared	3000 - 5000 nm	Emitted EMR proportional to temperature, not visible to the eye.
Long wave Infrared	8000 - 14000 nm	Emitted EMR proportional to temperature, not visible to the eye.
Visible Panchromatic	400 - 700 nm	Reflected light visible to the eye.
Visible and NIR	400 - 1100 nm	Reflected light including near infrared, not visible to the eye.

All optical and multispectral scanners include some or all of these generic bands. The multispectral scanners on satellites seldom cover the UV or blue bands because these bands suffer extreme atmospheric absorption and scattering.<sup>4</sup> Most satellites use a blue-green band instead of blue.<sup>5</sup>

The actual wavelengths covered by specific sensors vary slightly from sensor to sensor and some subdivide the bands. For example; Landsat's blue-green bandwidth is from 450 to 520 nm, the green is 520 to 600 nm and red is 630 to 690 nm. Landsat's NIR band covers from 760 to 900 nm. The SWIR is covered in two bands (1550 to 1750 nm and 2080 to 2350 nm). There is no mid wave IR band and the long wave IR band covers from 10400 to 12500 nm.

Other sensors use different bands. The differences are due to the technology at the time of the sensors' design, the detectors used or the specific applications for which the sensor was intended.

Most current multispectral scanners also include a visible panchromatic band, covering the entire visible region and sometime extending into the near infrared. This band generally yields higher resolution than the narrower bands (usually twice as good as the individual bands). The panchromatic band may be used alone or for "sharpening" (enhancing the spatial resolution) of the other bands. Sharpening does not actually improve the resolution of the narrow bands, but it allows an interpreter to visually associate the colors with the spatial detail of the panchromatic band.

<sup>4</sup> Most satellites with bands in the blue use them to measure clouds and haze rather than to image the earth. Likewise satellites with UV bands use them for measuring ozone concentration.

<sup>5</sup> Sea WiFS is an exception to this rule in that it has several blue bands. Sea WiFS's purpose is to support oceanographic research. For this application, blue band information is critical despite the difficulties in collecting it.

Synthetic aperture radars (SARs), scatterometers and passive microwave radiometers operate at the other end of the electromagnetic spectrum. Their bands of operation include wavelengths measured in centimeters and meters rather than nanometers and microns. Usually these bands are referred to by frequency (hertz or cycles per second) rather than by wavelength. In the microwave region the bands have been assigned letters rather than colors. Table 3 lists the standard microwave bands.

SAR's are active sensors which transmit energy and produce an image of the microwave reflectivity of the surface. They are capable of producing imagery day or night and through clouds. The resolution of a SAR is independent of range. It is a function of the transmitted bandwidth (for range resolution) and antenna beam width (for azimuth resolution). Scatterometers are active microwave instruments which do not form images, but rather provide only a statistical measure of the microwave reflectivity of the surface. Passive microwave radiometers measure the microwave emissivity of the surface (or brightness temperature). Their resolution is a function of their antenna beam width. Microwaves in the Ku, V and W bands are attenuated by rain and clouds. This makes them useful for meteorology.

Table 3. Microwave Bands

Band	Wavelength (cm)	Frequency (Ghz)
P Band	133 - 76.9	.225 - .39
L Band	76.9 - 19.4	.39 - 1.55
S Band	19.4 - 7.69	1.55 - 3.9
C Band	7.69 - 5.21	3.9 - 5.75
X Band	5.21 - 2.75	5.75 - 10.9
Ku Band	2.75 - 1.67	10.9 - 18
K Band	1.67 - 1.13	18 - 26.5
Ka Band	1.13 - 0.83	26.5 - 36.6
Q-Band	0.83 - 0.063	36.6 - 46
V Band	0.063 - 0.053	46 - 56
W Band	0.053 - 0.03	56 - 100

**5.4 Band Utility.** The various bands may be used alone or in combination with others to derive specific information. Tables 4,5 and 6 attempt to summarize the utility of a set of generic bands for a variety of applications. There are separate tables for Multispectral Imaging Systems, Synthetic Aperture Radars, and Passive Microwave Radiometers. The relative importance of a given band or bands have been rated according to the following criteria:

**Band Utility Definitions:**

**Primary (PRI)** - The single band with the highest information content related to the task. Used alone it can answer most of the problem.

**Alternate (ALT)** - A band which can provide almost as much information as the Primary band but not quite. The second choice if the Primary band is not

available. If two bands can provide the same information both will be listed as Alternates and no Primary band.

Substitute (SUB) - A band which can provide some information as the Primary or Alternate bands but not as accurately or efficiently. The third choice.

Essential (ESS) - One of several bands each of which are required as inputs into a multi-band transform or analysis process. All are equally important and if any are absent the process will not work.

Contributory (CON) - One of several bands in a multi-band process which add information but which are not necessarily required to perform the task.

Any (ANY) - One of many bands that can perform a task equally well.

One may enter the tables with an information element and produce a list of required or desirable bands which relate to the information element. Alternatively one may enter with a set of bands and produce a list of potential information elements. In this way they can provide insight into potential uses for specific sensors or data requirements for specific tasks. Note that these tables contain information on spatial resolution. Resolution requirements must be considered separately.



Table 4: Multispectral Band Applications

Information Element	Visible		Ultraviolet		Reflected				Mixed		Thermal	
	VIS/PAN .4-.7		UV .2-.3		BLUE .4-.5	BLU-GRN .45-.55	GREEN .5-.6	RED .6-.7	NIR .7-1.1	SWIR 1.1-2.5	MWIR 3.0-5.0	LWIR 8.0-14.0
Land Surface												
Assess Vegetation Vigor							CON	ESS	ESS	CON	CON	CON
Discriminate Surface Water from Land								ALT	ALT	ALT	ALT	ALT
Classify Surface Materials Spectrally	SUB		CON		CON	CON	CON	CON	CON	CON	CON	CON
Classify Surface Minerals Spectrally			CON		CON	CON	CON	CON	ESS	CON	CON	CON
Discriminate Soil Types by Emissivity										ALT	ALT	ALT
Discriminate Soil Types by Reflectance	SUB				CON	ESS	ESS	ESS	CON			
Discriminate Soil Types by Drainage Pattern	ALT				SUB	SUB	SUB	SUB	ALT	ALT	ALT	ALT
Detect & Measure Thermal Plumes										ALT	ALT	ALT
Detect Man-made Objects Spectrally			CON		CON	CON	CON	CON	CON	CON	CON	CON
Detect Man-made Objects Thermally										ALT	ALT	ALT
Estimate Land Surface Emissivity										ALT	ALT	ALT
Estimate Land Surface Temperature										ALT	ALT	ALT
Estimate Soil Moisture										ALT	ALT	ALT
Estimate Soil Moisture by Plant Indicators	SUB				SUB	SUB	SUB	ESS	ESS	CON	ALT	ALT
Map Land Surface Thermal Features												
Measure Topography by Stereo	PRI				SUB	SUB	SUB	SUB	SUB			
Spectral Land Use Classification					CON	CON	CON	CON	CON	CON	CON	CON
Visual Spatial Analysis	PRI											
Classify Vegetation by Species	SUB				CON	CON	CON	ESS	ESS	CON		CON
Classify Vegetation by Stage of Growth	SUB				CON	CON	CON	ESS	ESS	CON		CON
Detect Multispectral Change					CON	CON	CON	CON	CON	CON		CON
Detect Land Disturbances					CON	CON	CON	CON	CON	CON		CON
Detect Camouflage							CON	ESS	ESS	CON		CON
Detect Shallow Buried Objects	CON							CON	CON	ALT		ALT
Ice & Snow												
Detect & Classify Sea Ice	CON				CON	CON	CON	CON	CON	CON		CON
Classify Ice Types					CON	CON	CON	CON	CON	CON		CON
Classify Snow Types					ESS	ESS	ESS	CON	CON	ESS		CON
Estimate Snow & Ice Volume					ESS	ESS	ESS	CON	CON	ESS		CON

Table 4: Multispectral Band Applications (continued)

Information Element	Remarks
<b>Land Surface</b>	
Assess Vegetation Vigor	Red/NIR ratio is critical
Discriminate Surface Water from Land	Any IR band will do. Nighttime imagery is best for MWIR, and LWIR, NIR I best in Daylight.
Classify Surface Materials Spectrally	Several from each class, reflected, mixed & thermal
Classify Surface Minerals Spectrally	Several from each class, reflected, mixed & thermal
Discriminate Soil Types by Emissivity	Multiple thermal IR bands
Discriminate Soil Types by Reflectance	Multiple reflective bands
Discriminate Soil Types by Drainage Pattern	Resolution is important
Detect & Measure Thermal Plumes	Either thermal band
Detect Man-made Objects Spectrally	Several from each class, reflected, mixed & thermal
Detect Man-made Objects Thermally	Either thermal band
Estimate Land Surface Emissivity	Either thermal band
Estimate Land Surface Temperature	Either thermal band
Estimate Soil Moisture	Soil Moisture Often Manifests as a surface temperature difference, or as a lower reflectance
Estimate Soil Moisture by Plant Indicators	Indicator species and plant vigor are good clues to soil moisture
Map Land Surface Thermal Features	Multiple thermal IR bands
Measure Topography by Stereo	Resolution is important
Spectral Land Use Classification	Several from each class, reflected, mixed & thermal
Visual Spatial Analysis	Resolution is important for this task
Classify Vegetation by Species	As many reflective bands as practical
Classify Vegetation by Stage of Growth	As many bands as practical
Detect Multispectral Change	As many bands as practical
Detect Land Disturbances	As many bands as practical
Detect Camouflage	SWIR is important
Detect Shallow Buried Objects	Thermal bands show moisture effects, Red & Nir show vegetation changes, Visible can show subsidence
<b>Ice &amp; Snow</b>	
Detect & Classify Sea Ice	Several from each class, reflected, mixed & thermal
Classify Ice Types	Several from each class, reflected, mixed & thermal
Classify Snow Types	Several from each class, reflected, mixed & thermal
Estimate Snow & Ice Volume	Several from each class, reflected, mixed & thermal

Table 4: Multispectral Band Applications (continued)

Information Element	Visible		Ultraviolet		Reflected				Mixed		Thermal		
	VIS/PAN	4-7	UV	2-3	BLUE	BLU-GRN	GREEN	RED	NIR	SWIR	1.1-2.5	MWIR	LWIR
<b>Ocean, Lakes &amp; Coastal Regions</b>													
Estimate Water Depth					CON	ESS	ESS	CON	CON				
Detect Oil Sheens			PRI		ALT	ALT	ALT	ALT				ALT	ESS
Detect Oil Slicks	SUB		ESS		SUB	SUB	SUB	SUB				CON	CON
Detect Surfactants on Water	CON		CON		CON	CON	CON	CON	CON	CON		ALT	PRI
Estimate Water Surface Temperature					CON	ESS	ESS	ESS	CON				
Map Underwater Features	SUB				CON	ESS	ESS	ESS	CON				
Measure Ocean Surface Color					CON	ESS	ESS	ESS	CON				
Measure Ocean Waves				SUB	SUB	SUB	SUB	SUB				ALT	ALT
Detect Ship Wakes				SUB	SUB	SUB	SUB	SUB					
Classify Ship Wakes				SUB	SUB	SUB	SUB	SUB					
<b>Meteorology &amp; Climatology</b>													
Classify Clouds					CON	CON	CON	CON	CON			CON	CON
Discriminate Clouds from Land					ALT	ALT	ALT	ALT				ESS	ESS
Discriminate Clouds from Sea or Water					ALT	ALT	ALT	ALT			ESS	ESS	ESS
Discriminate Clouds from Snow & Ice					ALT	ALT	ALT	ALT			ESS	ESS	ESS
<b>Damage Assessment</b>													
Detect Fire	CON											ALT	ALT
Detect Smoke	PRI				ALT	ALT	ALT	ALT	SUB			CON	CON
Discriminate Smoke from Clouds	CON												
Condition of Roads, Bridges & Airfields													
Map Extent of Fire Damage	CON				CON	CON	CON	CON	CON	CON		CON	CON
Map Extent of Flood Damage	CON				CON	CON	CON	CON	CON	CON		CON	CON
Map Extent of Storm Damage	CON				CON	CON	CON	CON	CON	CON		CON	CON
Map Extent of Earthquake or Landslide Damage	CON				CON	CON	CON	CON	CON	CON		CON	CON

Table 4: Multispectral Band Applications (continued)

Information Element	Remarks
<b>Ocean, Lakes &amp; Coastal Regions</b>	
Estimate Water Depth	Several reflected bands (shorter wavelength blue and green are better) plus NIR for land-water boundary
Detect Oil Sheens	Short wavelengths are better UV or natural color composite will work
Detect Oil Slicks	Either thermal band and a UV to weed out false thermal signatures, visible bands may sometimes substitute for UV.
Detect Surfactants on Water	Several from each class, reflected, mixed & thermal
Estimate Water Surface Temperature	Either thermal band
Map Underwater Features	Several reflected band plus NIR for land-water boundary
Measure Ocean Surface Color	All reflected bands
Measure Ocean Waves	Resolution is important for this task
Detect Ship Wakes	Thermal wake persists much longer than the visible wake
Classify Ship Wakes	Resolution is important for this task
<b>Meteorology &amp; Climatology</b>	
Classify Clouds	The PAN band detect bright clouds and structure, several reflected bands either thermal bands to classify thickness.
Discriminate Clouds from Land	The PAN band or reflected band to detect bright clouds, and either thermal band to discriminate from land.
Discriminate Clouds from Sea or Water	The PAN band or reflected band to detect bright clouds, and SWIR and either thermal band to discriminate from snow/ice background
Discriminate Clouds from Snow & Ice	The PAN band or reflected band to detect bright clouds, and SWIR and either thermal band to discriminate from water background.
<b>Damage Assessment</b>	
Detect Fire	Either thermal band, SWIR for very hot fires, Red often out performs SWIR
Detect Smoke	Any and all reflected bands
Discriminate Smoke from Clouds	Reflected bands plus a SWIR
Condition of Roads, Bridges & Airfields	Resolution is important for this task
Map Extent of Fire Damage	As many bands as practical
Map Extent of Flood Damage	As many bands as practical
Map Extent of Storm Damage	As many bands as practical
Map Extent of Earthquake or Landslide Damage	As many bands as practical

Table 5: Synthetic Aperture Radar Applications

Information Elements	Polarization	Radar Reflectivity					
		Ku-Band 1.67-2.75 cm	X-Band 2.75-5.21 cm	C-Band 5.21-7.69 cm	S-Band 7.7-19.4 cm	L-Band 19.4-77 cm	P-Band 77- 133 cm
<b>Land Surface</b>							
Visual Spatial Analysis		ALT	FRI	FRI	ALT	SUB	SUB
Detect Man Made Features		ANY	ANY	ANY	ANY	ANY	ANY
RCS Analysis		ANY	ANY	ANY	ANY	ANY	ANY
Phase Analysis		ANY	ANY	ANY	ANY	ANY	ANY
Multipath Analysis		ANY	ANY	ANY	ANY	ANY	ANY
Foliage Penetration		SUB	SUB	ALT	ALT	FRI	FRI
Dry Soil Penetration		SUB	SUB	ALT	ALT	FRI	FRI
Material Penetration		SUB	SUB	ALT	ALT	FRI	FRI
Topography by SAR Stereo		ALT	ALT	ALT	ALT	ALT	ALT
Topography by Radar Interferometry		ALT	ALT	ALT	ALT	ALT	ALT
Vegetation Classification		FRI	FRI	FRI	ALT	SUB	SUB
<b>Ice &amp; Snow</b>							
Classify Snow by moisture Content		SUB	SUB	ALT	ALT	FRI	FRI
Discriminate Ice From Open Water		FRI	FRI	ALT	ALT	SUB	SUB
Discriminate First Year from Muliyear Ice		SUB	SUB	ALT	ALT	FRI	FRI
<b>Oceans, Lakes &amp; Coastal Regions</b>							
Detect & Measure Oil Slicks	X	FRI	FRI	ALT	ALT	SUB	SUB
Ship Wake Analysis	X	ANY	ANY	ANY	ANY	ANY	ANY
Surface Wave Analysis	X	ANY	ANY	ANY	ANY	ANY	ANY
Estimate Wind Velocity & Direction Over Water	X	ANY	ANY	ANY	ANY	ANY	ANY
Estimate Sea State	X	ANY	ANY	ANY	ANY	ANY	ANY
<b>Damage Assessment</b>							
Radar Change Detection		ALT	ALT	ALT	ALT	ALT	ALT
Assess Condition of Powerlines		ANY	ANY	ANY	ANY	ANY	ANY
Assess Condition of Roads Rails & Bridges		FRI	FRI	ALT	ALT	SUB	SUB
Assess Condition Dams & Levies		ANY	ANY	ANY	ANY	ANY	ANY
Assess Condition of Comm. Antennas		ANY	ANY	ANY	ANY	ANY	ANY
Assess Condition of Airfields	X	ANY	ANY	ANY	ANY	ANY	ANY
Assess Extent of Flood		ANY	ANY	ANY	ANY	ANY	ANY

Table 5: Synthetic Aperture Radar Applications (continued)

Information Elements	Remarks
<b>Land Surface</b>	
Visual Spatial Analysis	Shorter wavelengths are generally better.
Detect Man Made Features	Any wavelength
RCS Analysis	Requires calibration
Phase Analysis	Requires Complex Image
Multipath Analysis	Requires sensor models
Foliage Penetration	Longer wavelegths are better
Dry Soil Penetration	Longer wavelegths are better
Material Penetration	Longer wavelegths are better
Topography by SAR Stereo	Shorter wavelengths are better.
Topography by Radar Interferometry	Requires Complex Image, Longer wavelegths are easier
Vegetation Classification	Shorter wavelengths are better.
<b>Ice &amp; Snow</b>	
Classify Snow by moisture Content	Longer wavelegths are better
Discriminate Ice From Open Water	Shorter wavelengths are better.
Discriminate First Year from Muliyear Ice	Longer wavelengths are better
<b>Oceans, Lakes &amp; Coastal Regions</b>	
Detect & Measure Oil Slicks	Shorter wavelengths are better.
Ship Wake Analysis	Any wavelength
Surface Wave Analysis	Any wavelength
Estimate Wind Velocity & Direction Over Water	Any wavelength
Estimate Sea State	Any wavelength
<b>Damage Assessment</b>	
Radar Change Detection	Requires Complex Image
Assess Condition of Powerlines	Any wavelength
Assess Condition of Roads Rails & Bridges	Shorter wavelengths are better.
Assess Condition Dams & Levies	Any wavelength
Assess Condition of Comm. Antennas	Any wavelength
Assess Condition of Airfields	Any wavelength
Assess Extent of Flood	Any wavelength

Table 6: Passive Microwave Radiometer Applications

Information Elements	Brightness Temperature										
	L-Band 1.4 GHz	L-Band 3.0 GHz	C-Band 6.6 GHz	X-Band 10.7 GHz	Ku-Band 18.0 GHz	K-Band 21.0 GHz	Ka-Band 37.0 GHz	V-Band 55.0 GHz	W-Band 90.0 GHz	W-Band 183.0 GHz	
<b>Meteorology &amp; Climatology</b>											
Temperature Profile											
Water Vapor Profile											
Water Vapor Profile (Non-tropical)											
Liquid Water Abundance/Rain Rate											
Cloud Thickness											
Cloud Temperature											
Sea Surface Temperature											
Sea Surface Wind Speed											
Sea Surface Wind Speed (No precipitation)											
<b>Severe Storms</b>											
Temperature Profile											
Water Vapor Profile											
Water Vapor Profile (Non-tropical)											
Liquid Water Abundance/Rain Rate											
Sea Surface Temperature											
Sea Surface Wind Speed											
Sea Surface Wind Speed (No precipitation)											
<b>Ocean Surface</b>											
Sea Surface Wind Speed											
Sea Surface Wind Speed (No precipitation)											
Sea Surface Temperature											
Salinity											
Oil Slicks											
<b>Land Survey</b>											
Soil Moisture Content											
Soil Moisture Content											
Snow Cover Classification											
<b>Sea &amp; Ice</b>											
Sea Ice Concentration											
Sea Ice Classification											
Land Ice Concentration											

Adapted from Staelin & Rosenkrantz 1978

Spatial resolution and area coverage must often be traded against one another. This is due to limitation in the rate at which data can be transmitted. Adding bands is cheaper in this respect than increasing resolution or area coverage. Doubling the resolution or the area coverage quadruples the data to be transmitted. Adding a band only increases the data by a fraction.

Some general applications imply a need for certain minimum resolution or area coverage, for example:

#### **Meteorology**

- Extremely large area of coverage, up to the entire disk of the earth.
- Low resolution is acceptable from 10 to 1000 km.
- Radiometric accuracy is important.

#### **Oceans**

- Large areas are important
- Resolution from 100 m to 30 km are useful
- Sea ice and wave measurements require higher resolution 10 to 50 m.

#### **Land Mineral Resources**

- Large area coverage is important
- Multi sensor approach is very important
- Thermal bands are very useful
- Multi-seasonal coverage is important
- Multi-temporal and repeat coverage is important

#### **Agricultural Assessments and Land Use:**

- 10 to 30 m resolution
- Multispectral is very important
- Seasonal coverage is critical
- Large areas are preferred but mosaics are often acceptable

#### **Urban and Topographic mapping**

- 10 m. resolution or better
- Area coverage is secondary
- Stereo is essential for topography.

#### **Military Reconnaissance**

- Military requirements are broken down into Target Categories and level of analysis in Table 7 below (resolutions are in meters):<sup>6</sup>

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<sup>6</sup> Based on combined U.S. and NATO requirements as set forth in RADC-TR-90-370, "Imagery Interpretation Requirements for Reconnaissance Systems." Original resolution requirements stated in feet were converted to meters for consistency.



Table 7: Military Reconnaissance Resolution Requirements

Target Categories	General Detection	Classify-Type	Identify Variants	Characterize
Aircraft	5	2	1	0.3
Airfield Facilities	7	5	3	0.3
Artillery & Rockets	1	0.5	0.1	0.1
Bridges	7	3	1-2	0.3
Coast & Landing Beaches	15-30	3	1-2	0.3
Command & HQ	3	1-3	1	0.1
Land Mine fields	3	2-7	1	0.1
Missile Sites	3	2	1	0.3
Nuclear Weapons	3	2	0.3	0.1
Ports and Harbors	30	7-15	7	2-3
Radar Site	3	1	0.3	0.1
Communications Sites	3	1-2	0.3	0.1
Rail Roads & Yards	15-30	3-15	1-7	1
Roads	7-10	3-7	1-2	1
Supply Depots	3-5	1-2	0.3	0.1
Surface Ships	8-15	3	0.6	0.3
Surfaced Submarines	8-30	5-7	1	1
Terrain	N/A	100	3	3
Troop Convoys & Camps	7	2-3	1	0.3
Urban Areas	60-100	15-30	3	0.5
Military Vehicles	3	1	0.3	0.1

National level imagery requirements are compiled by various users within the intelligence community as Imagery Requirements Objectives Lists (IROLs). These lists are classified and are integrated at the national level as the Imagery Requirements Objectives File (IROF). IROF resolution requirements are listed according to the National Image Interpretation Rating Scale (NIIRS). While NIIRS is actually a composite scale based on several image quality parameters, if one assumes a clear sky and no sensor malfunctions it can be related to resolution as in Table 8.

Table 8: NIIRS Related to GSD<sup>7</sup>

NIIRS	1	2	3	4	5	6	7	8	9
GSD In meters	9.14	4.57	2.44	1.22	0.76	0.41	0.20	0.10	0.05
GSD In Ft.	30.00	15.00	8.00	4.00	2.50	1.33	0.67	0.33	0.17

<sup>7</sup> The NIIRS scale applies only to optical imagery. Scales for other sensor types are still classified.

**5.5 Platforms and Sensors.** This study considered two classes of platforms, satellites and aircraft.<sup>8</sup> A platform may carry a number of different sensors. Landsat carries both the Thematic Mapper and Multispectral Scanner. DMSF carries a suite of at least ten different sensors.

A list of platforms was created listing platforms by name, abbreviation and type (acft. or sat.). The table also includes, Nationality, Operating Agency, Orbit Type, Apogee, Perigee, Inclination, Revisit Interval in days for satellites (nadir and off-nadir), date of initial operational capability (IOC) and end of mission dates for completed discontinued missions.<sup>9</sup>

The platforms are linked to a sensor table which list all the sensors for each platform by name, abbreviation and sensor type ( MSI, SAR, MWR etc. ).

Sensors are linked to a sensor band table which lists:

- Band name (a unique name for each band).
- Band type (using the names as in Tables 4 and 5).
- Cut on and Cut off wavelengths (in nm) for optical and MSI systems.
- Center Frequency (in GHz) for Microwave systems.
- Band width (as text for all sensor types, for SARs this indicates multiple resolution modes).
- Resolution (in meters) nominal best possible.<sup>10</sup>
- Swath Width (in km) at the stated resolution.

Using the platform, sensor and band tables it is possible to search for a variety of combinations of characteristics. Examples are provided in the appendices.

Appendix A: All satellite sensors (platform type = SAT).<sup>11</sup>

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<sup>8</sup> The U.S. Space Shuttle is problematic in this regard. It is of limited duration, like an aircraft, but its sensors perform like those of a satellite, because of its altitude and orbital constraints. For the purpose of this study it has been classified as a satellite but may deserve its own classification.

<sup>9</sup> Revisit interval is based on the maximum time between repeat coverage at the equator. For polar orbiting satellites the interval decreases with latitude. Some sensors (such as ERS-1) have variable orbits and so have variable revisit intervals. Some sensors offer off nadir viewing capability. For these sensors revisit interval represents the ability to access an area without necessarily repeating the orbit.

<sup>10</sup> For most sensors the resolution value is the GSD. For some radiometers a GSD was computed based on IFOV and orbital altitude. Some sensors offer variable resolution. The best possible resolution is listed. Landsat TM's nominal resolution is 30 meters although some sites can process it to 27.5 m. Resolutions for SARs are the best impulse response (IPR). Limb sounder resolutions are in the vertical dimension, all others are ground resolutions at nadir at perigee.

<sup>11</sup> Some sensors have no resolution value. It is either not available or is not applicable to the sensor (such as an HF noise monitor). Appendix A lists all sensors for which resolution is not zero or blank.

**Appendix B:** SAR satellite sensors (platform type = SAT and sensor type = SAR)

**Appendix C:** Satellite sensors with resolution better or equal to LANDSAT Thematic Mapper (RESMETER  $\leq$  30). Notice that the LWIR band for Landsat is not listed because its GSD is 120 meters. ADEOS, Eyeglass, IRS-C/D, RadarSat, and WorldView are not yet operational (note the IOC dates).

The last query is probably the most instructive because many government users are familiar with Landsat and SPOT.

The band types in these tables can be related to the generic band types used by Tables 3,4 and 5.

For example, if you wanted a list of sensors with potential for producing vegetation index, (from Table 6), you could search Table 6 for useful bands (red and NIR) and then query the sensor band and table for all sensors with both a red and NIR band.

**6.0 Database Development.** The data compiled in the course of this study were initially entered into flat files using Microsoft Excel. Once the relational nature of the data became apparent these files were converted into FoxPro database files.

Foxpro 2.5 was chosen for several reasons.

- It was inexpensive
- It offered cross platform operation on both IBM and Macintosh PC's
- It uses Standard Query Language (SQL) which would permit files to be transferred to another SQL databases, such as oracle.
- It offered the potential for generation of forms and reports with which to customize a user interface.

## **7.0 Conclusions and Recommendations.**

**7.1 Conclusions.** The data gathered in this study, while by no means complete, is adequate to permit a fairly rigorous examination of sensor utility for a variety of tasks. The basic data structure used seems sound. The answers produced by queries on the data base make sense.

While FoxPro 2.5 is a fairly powerful database program, it is not a pure SQL database. It uses a mixture of SQL and DBASE commands. While the data structures and tables are easily transferable to other platforms the user interface is not. Microsoft is planning a UNIX version of FoxPro but no delivery date has been announced.

While FoxPro has some impressive query capabilities and customization options, it is not for the novice user. Formulating complex queries is not difficult, but it requires the user to have a great deal of knowledge about the data base. FoxPro had its origins under DOS. In order to maintain DOS cross-platform compatibility it enforces DOS-like limitations on file names and adds file extensions. This leads to some rather arcane file and record names which in turn make navigating the database difficult for a new user.

In the opinion of the programmer who worked with it, FoxPro offers no significant advantages over ORACLE nor any other relational database already available for UNIX.

**7.2 Recommendations.** The current database tables and link files should be transferred to a UNIX based system and incorporated into the RDAST database. Some additional data fields have been identified as potentially useful.

In the User tables:

- Fax Number, this field has been added some numbers are known, but many would have to be confirmed.
  - Point of Contact, many are already known, putting them in a database would require compliance with the Privacy Act.
  - Internet/EMail address, these would have to be researched.

In the Sensor Band Table:

- Sensitivity, (a value for noise equivalent power, temperature or reflectivity). This field was omitted because the values are not widely published for most sensors. Locating this data would require additional work.

In the Sensor Table:

- Levels of Processing Available, such as radiometric corrections, geometric corrections, geocoding etc. This data is available for SPOT and Landsat and some NOAA satellites, but is not listed for most other sensors.

The sensor tables will be ported to the Unix system. A global query on the Users table and on the Sensor tables will be converted to Filemaker files to permit browsing by non-relational database programs on PC's.

**Appendix A: Database Listing of all Satellite Sensors**

<b>ADEOS</b>		<b>Advanced Earth Observing Satellite</b>			
Agency: NASDA		Country: JAPAN		loc: 01/01/96 Eom: / /	
Orbit: SUN SYNCHRONOUS		Apogee 800 km Perigee 800km		Incl.: 98.6° Repeat: 41 days	
<b>AVNIR</b>		<b>Advanced Visible &amp; Near Infrared Radiometer</b>			<b>MSI</b>
		Stereo Capability: Cross Track		Off Axis Repeat: 1 Day	
Band(s)				Resolution	Swath
AVNIR-1	BLUEGREEN	0.420 -	0.520um	16.0 m	80 km
AVNIR-2	GREEN	0.520 -	0.600um	16.0 m	80 km
AVNIR-3	RED	0.630 -	0.690um	16.0 m	80 km
AVNIR-4	NIR	0.760 -	0.860um	16.0 m	80 km
AVNIR-PAN	VISIBLE	0.400 -	0.700um	8.0 m	80 km
<b>ILAS</b>		<b>Improved Limb Atmospheric Spectrometer</b>			<b>SPEC</b>
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ILAS-1	NIR	0.753 -	0.784um	500000.0 m	3000 km
ILAS-2	H2OABS	6.210 -	11.770um	500000.0 m	3000 km
<b>IMG</b>		<b>Interferometric Monitor for Greenhouse Gases</b>			<b>RAD</b>
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
IMG-1	H2OABS	3.300 -	4.300um	8000.0 m	8 km
IMG-2	CO2ABS	4.000 -	5.000um	8000.0 m	8 km
IMG-3	H2OABS	5.000 -	14.000um	8000.0 m	8 km
<b>NSCAT</b>		<b>NASA Scatterometer</b>			<b>SCAT</b>
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
NSCAT	KU-BAND	14.000 -	GHz	50000.0 m	1200 km
<b>OCTS</b>		<b>Ocean Color &amp; Temperature Scanner</b>			<b>MSI</b>
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
OCTS-01	BLUE	0.400 -	0.450um	700.0 m	1400 km
OCTS-02	BLUEGREEN	0.450 -	0.500um	700.0 m	1400 km
OCTS-03	GREEN	0.500 -	0.550um	700.0 m	1400 km
OCTS-04	GREEN	0.550 -	0.600um	700.0 m	1400 km
OCTS-05	RED	0.600 -	0.650um	700.0 m	1400 km
OCTS-06	RED	0.650 -	0.700um	700.0 m	1400 km
OCTS-07	NIR	0.700 -	0.900um	700.0 m	1400 km
OCTS-08	NIR	0.900 -	1.100um	700.0 m	1400 km
OCTS-09	MWIR	3.000 -	5.000um	700.0 m	1400 km
OCTS-10	LWIR	8.500 -	10.500um	700.0 m	1400 km
OCTS-11	LWIR	10.500 -	12.600um	700.0 m	1400 km
OCTS-12	LWIR	8.500 -	14.000um	700.0 m	1400 km
<b>POLDER</b>		<b>Polarization and Directionality of Earth's Reflectances</b>			<b>RAD</b>
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
POL-1	BLUEGREEN	0.433 -	0.463um	6000.0 m	2200 km
POL-1P	BLUEGREEN	0.433 -	0.463um	Polarized	6000.0 m 2200 km
POL-2	GREEN	0.480 -	0.500um	6000.0 m	2200 km
POL-3	GREEN	0.555 -	0.575um	6000.0 m	2200 km
POL-4P	RED	0.660 -	0.690um	Polarized	6000.0 m 2200 km
POL-5	NIR	0.753 -	0.773um	6000.0 m	2200 km
POL-6	NIR	0.745 -	0.785um	6000.0 m	2200 km
POL-7P	NIR	0.845 -	0.885um	Polarized	6000.0 m 2200 km
POL-8	NIR	0.900 -	0.920um	6000.0 m	2200 km

TOMS		Total Ozone Mapping Spectrometer				SPEC
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
TOMS-1	UV	0.300 -	0.308um		40000.0 m	2795 km
TOMS-2	UV	0.310 -	0.315um		40000.0 m	2795 km
TOMS-3	UV	0.315 -	0.320um		40000.0 m	2795 km
TOMS-4	UV	0.320 -	0.330um		40000.0 m	2795 km
TOMS-5	UV	0.330 -	0.335um		40000.0 m	2795 km
TOMS-6	UV	0.355 -	0.365um		40000.0 m	2795 km

ALMAZ-1		ALMAZ-1 S/C SARSAT				
Agency: RSA		Country: RUSSIA		loc: 03/31/91	Eom: / /	
Orbit: POLAR		Apogee	300 km	Perigee	360km	Incl.: 72.7° Repeat: n/a

MAZ-1		ALMAZ-1, Synthetic Aperture Radar				SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
S-SAR	S-BAND	3.125 -	GHz		10.0 m	40 km

UHF-RAD		ALMAZ-1, UHF Radiometer				MWR
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MAZ-1	Q-BAND	37.500 -	GHz		5000.0 m	30 km
MAZ-2	X-BAND	6.000 -	GHz		5000.0 m	30 km
MAZ-3	K-BAND	25.000 -	GHz		5000.0 m	30 km
MAZ-3	K-Band	27.200 -	GHz		5000.0 m	30 km
MAZ-5	K-BAND	21.900 -	GHz		5000.0 m	30 km

ALMAZ-1B		ALMAZ-1B, Earth Remote Sensing Satellite				
Agency: RSA		Country: RUSSIA		loc: 12/31/96	Eom: / /	
Orbit: POLAR		Apogee	400 km	Perigee	400km	Incl.: 73.0° Repeat: Variable

BALKAN-2		Balkan-2 Lidar				LIDAR
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
BAL-1	GREEN	0.532 -	um	ND YAG	10.0 m	140 km

MSU-E		Multispectral Scanner of High Resolution				MSI
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSU-E-1	GREEN	0.500 -	0.600um		33.0 m	80 km
MSU-E-2	RED	0.600 -	0.700um		33.0 m	80 km
MSU-E-3	NIR	0.800 -	0.900um		33.0 m	80 km

MSU-SK		Multispectral Scanner of Mod Conical Scan				MSI
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSU-SK-1	GREEN	0.500 -	0.600um		170.0 m	600 km
MSU-SK-2	RED	0.600 -	0.700um		170.0 m	600 km
MSU-SK-3	NIR	0.700 -	0.800um		170.0 m	600 km
MSU-SK-4	NIR	0.800 -	1.100um		170.0 m	600 km
MSU-SK-5	LWIR	10.400 -	12.600um		600.0 m	600 km

OSSI		Optronic Sensor for Stereo Imagery				MSI
Band(s)		Stereo Capability: Fwd/Aft		Off Axis Repeat:	Resolution	Swath
OSSI-1	GREEN	0.500 -	0.600um		4.0 m	80 km
OSSI-2	RED	0.600 -	0.700um		4.0 m	80 km
OSSI-2	NIR	0.700 -	0.800um		4.0 m	80 km
OSSI-PAN	VNIR	0.580 -	0.800um		2.5 m	80 km

SAR-10		ALMAZ-1B, Synthetic Aperture S-Band Radar				SAR
Band(s)		Stereo Capability:		Off Axis Repeat:		Swath
				Resolution		
SAR-10	S-BAND	3.130 -	GHz VV,HH,	15.0 m	170 km	
SAR-10	S-BAND	3.130 -	GHz VV,HH,	5.0 m	55 km	
SAR-10	S-BAND	3.130 -	GHz VV,HH,	15.0 m	70 km	
SAR-3		ALMAZ-1B, Synthetic Aperture X-Band Radar				SAR
Band(s)		Stereo Capability:		Off Axis Repeat:		Swath
				Resolution		
SAR-3	X-BAND	8.600 -	GHz VV	5.0 m	35 km	
SAR-70		ALMAZ-1B, Synthetic Aperture P-Band Radar				SAR
Band(s)		Stereo Capability:		Off Axis Repeat:		Swath
				Resolution		
SAR-70	P-BAND	43.00 -	MHz VV,HH,	22.0 m	170 km	
SLR-3		ALMAZ-1B, Real Aperture Radar				SLR
Band(s)		Stereo Capability:		Off Axis Repeat:		Swath
				Resolution		
SLR-3	X-BAND	8.600 -	GHz VV	1200.0 m	450 km	
SROM		Spectroradiometer for Ocean Monitoring				MSI
Band(s)		Stereo Capability:		Off Axis Repeat:		Swath
				Resolution		
SROM-1	BLUE	0.405 -	0.422um	600.0 m	2200 km	
SROM-10	LWIR	10.500 -	11.500um	600.0 m	2200 km	
SROM-2	BLUEGREEN	0.433 -	0.453um	600.0 m	2200 km	
SROM-3	BLUEGREEN	0.480 -	0.500um	600.0 m	2200 km	
SROM-4	GREEN	0.521 -	0.530um	600.0 m	2200 km	
SROM-5	GREEN	0.555 -	0.575um	600.0 m	2200 km	
SROM-6	RED	0.655 -	0.675um	600.0 m	2200 km	
SROM-7	NIR	0.745 -	0.785um	600.0 m	2200 km	
SROM-8	NIR	0.843 -	0.884um	600.0 m	2200 km	
SROM-9	MWIR	3.600 -	3.900um	600.0 m	2200 km	
CBERS		China-Brazil Earth Resources Satellite				
Agency: INPE CSA		Country: CHINA BRAZIL		loc: 12/31/96		Eom: / /
Orbit: SUN SYNCHRONOUS		Apogee 778 km Perigee 778km		Incl.: 98.5° Repeat: 26 Days		
CCD		Charge-Coupled Device Camera				MSI
Band(s)		Stereo Capability: Cross Track		Off Axis Repeat: 3 Days		Swath
				Resolution		
CCD-1	VISIBLE	0.510 -	0.730um	19.5 m	120 km	
CCD-2	BLUEGREEN	0.450 -	0.520um	19.5 m	120 km	
CCD-3	GREEN	0.520 -	0.590um	19.5 m	120 km	
CCD-4	RED	0.630 -	0.690um	19.5 m	120 km	
CCD-5	NIR	0.770 -	0.890um	19.5 m	120 km	
IR-MSS		Infrared Multispectral Scanner				MSI
Band(s)		Stereo Capability: Cross Track		Off Axis Repeat: 3 Days		Swath
				Resolution		
IR-MSS-1	VISNIR	0.500 -	1.100um	78.0 m	120 km	
IR-MSS-2	SWIR	1.550 -	1.750um	78.0 m	120 km	
IR-MSS-3	SWIR	2.080 -	2.350um	78.0 m	120 km	
IR-MSS-4	LWIR	10.400 -	12.500um	156.0 m	120 km	
WFI		Wide Field Imager				MSI
Band(s)		Stereo Capability:		Off Axis Repeat:		Swath
				Resolution		
WFI-1	RED	0.630 -	0.690um	260.0 m	856 km	
WFI-2	NIR	0.770 -	0.890um	260.0 m	856 km	



<b>COSMOS 1870</b>		<b>COSMOS 1870, ALMAZ Prototype, USSR</b>			
Agency: RSA	Country: RUSSIA	loc: 07/25/87		Eom: 07/30/89	
Orbit: CIRCULAR	Apogee 275 km	Perigee 275 km	Incl.: 73.0°	Repeat: n/a	

**S-Band SAR** **COSMOS 1870, Synthetic Aperture Radar** SAR

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SAR-1870 S-BAND 3.125 - GHz VV	25.0 m	20 km

<b>CRESS</b>		<b>Civillan Remote Sensing Satellite</b>			
Agency: LOCKHEED	Country: USA	loc: / /		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee 0 km	Perigee 0 km	Incl.: 98.0°	Repeat: 247	

**CRSS-1** **CRSS Stereo Sensor** E-O

Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)	Resolution	Swath
CRSS-1 VISIBLE 0.450 - 0.800um Stereo	1.0 m	0 km

<b>DMSP</b>		<b>Defense Meteorological Satellite Program 5-D</b>			
Agency: DOD	Country: USA	loc: 09/11/76		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee 850 km	Perigee 850 km	Incl.: 99.0°	Repeat: 16 Days	

**OLS** **Operational Linescan System** RAD

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
OLS-1 VISNIR 0.410 - 1.100um	550.0 m	2925 km
OLS-2 LWIR 10.500 - 12.600um	550.0 m	2925 km

**SSC** **Special Sensor C (Snow-Cloud Discriminator)** RAD

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SSC NIR 1.510 - 1.630um	12500.0 m	600 km

**SSD** **Special Sensor D (Atmospheric Density Sensor)** RAD

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SSD UV 0.200 - 0.400um	36000.0 m	1500 km

**SSH** **Special Sensor H (Humidity, Temperature Ozone Sounder)** RAD

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SSH 1 NIR 0.900 - 1.100um	39000.0 m	2000 km
SSH 2 LWIR 10.500 - 12.600um	39000.0 m	2000 km
SSH 3-8 CO2ABS 15.000 - 22.000um	39000.0 m	2000 km
SSH 9-16 H2OABS 22.000 - 30.000um	39000.0 m	2000 km

**SSM/I** **Special Sensor M/I (Microwave Environmental Sensor)** MWR

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SSMI-1 K-BAND 19.350 - GHz V	50000.0 m	1400 km
SSMI-2 K-BAND 22.230 - GHz V	50000.0 m	1400 km
SSMI-3 Q-BAND 37.000 - GHz V	25000.0 m	1400 km
SSMI-4 W-BAND 85.500 - GHz V	25000.0 m	1400 km
SSMI-5 W-BAND 85.500 - GHz H	25000.0 m	1400 km
SSMI-6 Q-BAND 37.000 - GHz H	25000.0 m	1400 km
SSMI-7 K-BAND 19.350 - GHz H	50000.0 m	1400 km

**SSM/T** **Special Sensor M/T (Passive Microwave Temperature Sounder)** MWR

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SSMT-1 V-BAND 50.500 - GHz	175000.0 m	1050 km

**Appendix A, All Satellites**

09/30/94

SSMT-2	V-BAND	53.200 -		GHz	175000.0 m	1050 km
SSMT-3	V-BAND	54.350 -		GHz	175000.0 m	1050 km
SSMT-4	V-BAND	54.900 -		GHz	175000.0 m	1050 km
SSMT-5	W-BAND	58.825 -		GHz	175000.0 m	1050 km
SSMT-6	W-BAND	58.400 -		GHz	175000.0 m	1050 km
SSMT-7	W-BAND	59.400 -		GHz	175000.0 m	1050 km

<b>EOS AEROSOL</b>		<b>Earth Observation System, Aerosol Mission</b>				
Agency: NASA	Country: USA	loc: 10/10/00		Eom: / /		
Orbit: CIRCULAR	Apogee	705 km	Perigee	705 km	Incl.: 57.0° Repeat:	

<b>EOSP</b>		<b>Earth Observing Scanning Polarimeter</b>				<b>RAD</b>
		Stereo Capability:		Off Axis Repeat:		
Band(s)				Resolution	Swath	
EOSP 1-12	VNIR	0.410 -	2.250um	12 Polarized	10000.0 m	13000 km

<b>SAGE III</b>		<b>Stratospheric Aerosol &amp; Gas Experiment III</b>				<b>RAD</b>
		Stereo Capability:		Off Axis Repeat:		
Band(s)				Resolution	Swath	
SAGE 1-9	VNIR	0.290 -	1.550um	Vertical res	2000.0 m	0 km

<b>EOS ALT-1</b>		<b>Earth Observation System, Altimeter Mission</b>				
Agency: NASA	Country: USA	loc: 01/01/02		Eom: / /		
Orbit: TBD	Apogee	0 km	Perigee	0 km	Incl.: 0.0° Repeat:	

<b>EOS-ALT</b>		<b>EOS Altimeter</b>				<b>ALT</b>
		Stereo Capability:		Off Axis Repeat:		
Band(s)				Resolution	Swath	
EOS-ALT-1	KU-BAND	13.600 -		GHz H	25000.0 m	2 km
EOS-ALT-2	C-BAND	5.300 -		GHz H	25000.0 m	2 km

<b>EOS AM-1</b>		<b>Earth Observation System, Ante Meridian Mission</b>				
Agency: NASA	Country: USA	loc: 01/01/98		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	705 km	Perigee	705 km	Incl.: 99.0° Repeat: 49 DAYS	

<b>ASTER</b>		<b>Advanced Spaceborne Thermal Emission &amp; Radiation Radiometer</b>				<b>RAD</b>
		Stereo Capability: Fwd/Aft		Off Axis Repeat: 5 Days		
Band(s)				Resolution	Swath	
ASTER-LWIR	LWIR	8.000 -	14.000um	5 Bands	90.0 m	0 km
ASTER-SWIR	SWIR	1.600 -	2.500um	6 Bands	30.0 m	0 km
ASTER-VNIR	VNIR	0.500 -	0.900um	3 Bands	15.0 m	0 km

<b>CERES</b>		<b>Clouds &amp; Earth's Radiant Energy System</b>				<b>RAD</b>
		Stereo Capability:		Off Axis Repeat:		
Band(s)				Resolution	Swath	
CERES-1	VNIR LWIR	0.300 -	50.000um	Total Radiance	21000.0 m	13000 km
CERES-2	VNIR MWIR	0.300 -	5.000um	Shortwave	21000.0 m	13000 km
CERES-3	LWIR	8.000 -	14.000um	Longwave	21000.0 m	13000 km

<b>MISR</b>		<b>Multi-angle Imaging Spectrometer</b>				<b>MSI</b>
		Stereo Capability:		Off Axis Repeat:		
Band(s)				Resolution	Swath	
MISR-1	BLUEGREEN	0.423 -	0.463um		240.0 m	356 km
MISR-2	GREEN	0.535 -	0.575um		240.0 m	356 km
MISR-3	RED	0.650 -	0.690um		240.0 m	356 km
MISR-4	NIR	0.845 -	0.885um		240.0 m	356 km

<b>MODIS</b>		<b>Moderate Resolution Imaging Spectrometer</b>				<b>RAD</b>
		Stereo Capability:		Off Axis Repeat:		
Band(s)				Resolution	Swath	
MODIS 1-36	VNIR LWIR	0.400 -	15.000um	2-29 selectable	250.0 m	0 km

<b>MOPITT</b>		<b>Measurement Of Pollution In The Troposphere</b>				<b>SPEC</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
MOPITT-1 SWIR		2.300 -	um	22000.0 m		640 km	
MOPITT-2 SWIR		2.400 -	um	22000.0 m		640 km	
MOPITT-3 MWIR		4.700 -	um	22000.0 m		640 km	
<b>EOS CHEM-1</b>		<b>Earth Observation System, Chemistry Mission</b>					
Agency: NASA		Country: USA		loc: 01/01/02		Eom: / /	
Orbit: SUN SYNCHRONOUS		Apogee 0 km Perigee 0 km		Incl.: 0.0°		Repeat:	
<b>NSCAT II</b>		<b>NASA "Stick" Scatterometer, NSCAT II "SeaWinds"</b>				<b>SCAT</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
STIK-SCAT KU-BAND		14.000 -	GHz	25000.0 m		600 km	
<b>SAGE III</b>		<b>Stratospheric Aerosol &amp; Gas Experiment III</b>				<b>RAD</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
SAGE 1-9 VNIR		0.290 -	1.550um	Vertical res	2000.0 m		0 km
<b>EOS PM-1</b>		<b>Earth Observation System, Post Meridian Mission</b>					
Agency: NASA		Country: USA		loc: 01/03/00		Eom: / /	
Orbit: SUN SYNCHRONOUS		Apogee 705 km Perigee 705 km		Incl.: 99.0°		Repeat:	
<b>AIRS</b>		<b>Atmospheric InfraRed Sounder</b>				<b>NADIR LIMB</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
AIRS 1-6 VNIR		0.400 -	1.700um	6 Channels	13500.0 m		1650 km
AIRS-IR MWIR LWIR		3.740 -	15.400um	2300 Channels	13500.0 m		1650 km
<b>AMSU-A</b>		<b>Advanced Microwave Sounding Unit</b>				<b>MWR</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
AMSU 1-15 SWIR LWIR		2.500 -	15.000um	15 Channels	40000.0 m		0 km
<b>CERES</b>		<b>Clouds &amp; Earth's Radiant Energy System</b>				<b>RAD</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
CERES-1 VNIR LWIR		0.300 -	50.000um	Total Radiance	21000.0 m		13000 km
CERES-2 VNIR MWIR		0.300 -	5.000um	Shortwave	21000.0 m		13000 km
CERES-3 LWIR		8.000 -	14.000um	Longwave	21000.0 m		13000 km
<b>MHS</b>		<b>Microwave Humidity Sounder</b>				<b>MWR</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
MHS-1 W-BAND		89.000 -	GHz		13500.0 m		1650 km
MHS-2 W-BAND		166.000 -	GHz		13500.0 m		1650 km
MHS-3 W-BAND		183.300 -	GHz		13500.0 m		1650 km
MHS-4 W-BAND		183.300 -	GHz	H	13500.0 m		1650 km
MHS-5 W-BAND		183.300 -	GHz	V	13500.0 m		1650 km
<b>MIMR</b>		<b>Multi-frequency Imaging Microwave Radiometer</b>				<b>MWR</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
MIMR-1 W-BAND		90.000 -	GHz	HV	4860.0 m		1400 km
MIMR-2 Q-BAND		36.500 -	GHz	HV	11620.0 m		1400 km
MIMR-3 K-BAND		23.800 -	GHz	HV	22300.0 m		1400 km
MIMR-4 X-BAND		10.650 -	GHz	HV	38600.0 m		1400 km
MIMR-5 X-BAND		6.800 -	GHz	HV	60300.0 m		1400 km

ERBS		Earth Radiation Budget Satellite			
Agency: NASA	Country: USA	loc: 10/05/84		Eom: / /	
Orbit: CIRCULAR	Apogee	610 km	Perigee	610 km	Incl.: 57.0° Repeat:

**ERBE Earth Radiation Budget Experiment RAD**

ERBE		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ERBE 1-5	UV LWIR	0.200 -	50.000 um	1300000.0 m	130000 km
ERBE 6	UV MWIR	0.200 -	5.000 um	1300000.0 m	130000 km
ERBE 7	MWIR LWIR	5.000 -	50.000 um	1300000.0 m	130000 km
ERBE 8	UV LWIR	0.200 -	50.000 um	1300000.0 m	130000 km

**SAGE III Stratospheric Aerosol & Gas Experiment III RAD**

SAGE III		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
SAGE 1-9	VNIR	0.290 -	1.550 um	Vertical res	2000.0 m
					0 km

ERS-1		European Remote Sensing Satellite 1			
Agency: ESA	Country: EUROPEAN	loc: 07/17/91		Eom: / /	
Orbit: CIRCULAR	Apogee	610 km	Perigee	610 km	Incl.: 57.0° Repeat: 35 Days

**ATSR-IRR Along Track Scanning Radiometer Infrared Radiometer RAD**

ATSR-IRR		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ATSR IR-1	SWIR	1.600 -	um	1000.0 m	500 km
ATSR IR-2	MWIR	3.600 -	um	1000.0 m	500 km
ATSR IR-3	LWIR	11.000 -	um	1000.0 m	500 km
ATSR IR-4	LWIR	12.000 -	um	1000.0 m	500 km

**ATSR-MWS Along Track Scanning Radiometer Microwave Sounder MWR**

ATSR-MWS		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ATSR MW-1	K-BAND	23.800 -	GHZ	20000.0 m	500 km
ATSR MW-1	KU-BAND	36.500 -	GHZ	20000.0 m	500 km

**ERS-ALT ERS Altimeter ALT**

ERS-ALT		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ERS-ALT	KU-BAND	13.700 -	GHz VV	20.0 m	80 km

**ERS-AMI ERS Synthetic Aperture Radar SAR**

ERS-AMI		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ERS-AMI1	C-BAND	5.360 -	GHz VV Image	30.0 m	100 km
ERS-AMI2	C-BAND	5.360 -	GHz LV Wave	30.0 m	100 km

**ERS-SCAT ERS Scatterometer SCAT**

ERS-SCAT		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ERS-SCAT	C-BAND	3.360 -	GHz VV	25000.0 m	500 km

ERS-2		European Remote Sensing Satellite 2			
Agency: ESA	Country: EUROPEAN	loc: 12/31/94		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	824 km	Perigee	824 km	Incl.: 0.0° Repeat:

**AATSR-MWS Advanced Along Track Scanning Radiometer Microwave Sounder MWR**

AATSR-MWS		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
ATSR MW-1	K-BAND	23.800 -	GHz	20000.0 m	500 km
ATSR MW-2	KU-BAND	36.500 -	GHz	20000.0 m	500 km

<b>AATSR-VIRR</b>					<b>Advanced Along Track Scanning Radiometer Vis-IR Radiometer</b>		<b>RAD</b>	
Stereo Capability:					Off Axis Repeat:			
Band(s)					Resolution		Swath	
AATSR-1	RED	0.65 -	um		500.0 m		500 km	
AATSR-2	NIR	0.850 -	um		500.0 m		500 km	
AATSR-3	H2O ABS	1.270 -	um		500.0 m		500 km	
AATSR-4	SWIR	1.600 -	um		500.0 m		500 km	
AATSR-IR-1	SWIR	1.600 -	um		1000.0 m		500 km	
AATSR-IR-2	MWIR	3.600 -	um		1000.0 m		500 km	
AATSR-IR-3	LWIR	11.000 -	um		1000.0 m		500 km	
AATSR-IR-4	LWIR	12.000 -	um		1000.0 m		500 km	

<b>ERS-ALT</b>					<b>ERS Altimeter</b>		<b>ALT</b>	
Stereo Capability:					Off Axis Repeat:			
Band(s)					Resolution		Swath	
ERS-ALT	KU-BAND	13.700 -	GHz	VV	20.0 m		80 km	

<b>ERS-AMI</b>					<b>ERS Synthetic Aperture Radar</b>		<b>SAR</b>	
Stereo Capability:					Off Axis Repeat:			
Band(s)					Resolution		Swath	
ERS-AMI1	C-BAND	5.360 -	GHz	VV Image	30.0 m		100 km	
ERS-AMI2	C-BAND	5.360 -	GHz	LV Wave	30.0 m		100 km	

<b>ERS-SCAT</b>					<b>ERS Scatterometer</b>		<b>SCAT</b>	
Stereo Capability:					Off Axis Repeat:			
Band(s)					Resolution		Swath	
ERS-SCAT	C-BAND	3.360 -	GHz	VV	25000.0 m		500 km	

<b>GOME</b>					<b>Global Ozone Monitoring Experiment</b>		<b>SPEC</b>	
Stereo Capability:					Off Axis Repeat:			
Band(s)					Resolution		Swath	
GOME-1	UV	0.240 -	0.295um	512 Channels	40000.0 m		320 km	
GOME-2	UV	0.290 -	0.405um	1024 Channels	40000.0 m		320 km	
GOME-3	BLUE	0.400 -	0.605um	1024 Channels	40000.0 m		320 km	
GOME-4	GREEN RED	0.590 -	0.790um	1024 Channels	40000.0 m		320 km	

<b>Eyeglass</b>					<b>Orbital Sciences &amp; Eyeglass International</b>			
Agency: CIV	Country: USA	loc: 01/01/97		Eom: / /				
Orbit: SUN SYNCHRONOUS	Apogee	710 km	Perigee	710km	Incl.: 0.0°	Repeat: 197 Days		

<b>Eyeglass</b>					<b>Eyeglass</b>		<b>E-O</b>	
Stereo Capability: Fwd/Aft					Off Axis Repeat: 2 Days			
Band(s)					Resolution		Swath	
EYEGLOSS-P	VISIBLE	0.400 -	0.700um		1.0 m		15 km	

<b>FENGYUN 1</b>					<b>Wind and Cloud Meteorological Satellites</b>			
Agency: SMA	Country: CHINA	loc: 10/07/88		Eom: / /				
Orbit: SUN SYNCHRONOUS	Apogee	900 km	Perigee	900km	Incl.: 99.1°	Repeat: Daily		

<b>VHRSR</b>					<b>Very High Resolution Scanning Radiometer Vis &amp; IR</b>		<b>MSI</b>	
Stereo Capability:					Off Axis Repeat:			
Band(s)					Resolution		Swath	
VHRSR-1	RED	0.580 -	0.680um		1100.0 m		3235 km	
VHRSR-2	NIR	0.725 -	1.100um		1100.0 m		3235 km	
VHRSR-3	BLUEGREEN	0.480 -	0.530um		1100.0 m		3235 km	
VHRSR-4	GREEN	0.530 -	0.580um		1100.0 m		3235 km	
VHRSR-5	LWIR	10.500 -	12.500um		1100.0 m		3235 km	

<b>FENGYUN 2</b>					<b>Wind and Cloud Meteorological Satellites</b>			
Agency: SMA	Country: CHINA	loc: 12/31/94		Eom: / /				
Orbit: GEOSTATIONARY 105E	Apogee	37000 km	Perigee	37000km	Incl.: 0.0°	Repeat: Continuous		

SCANRAD		Scanning Radiometer		RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:	
				Resolution	
				Swath	
SCANRAD-1	VINIR	0.550 -	1.050um	1430.0 m	6000 km
SCANRAD-2	LWIR	10.500 -	12.500um	5730.0 m	6000 km
SCANRAD-3	H2O ABS	6.300 -	7.600um	5730.0 m	6000 km

GMS		Geostationary Meteorological Satellite			
Agency: JMA	Country: JAPAN	loc: 12/31/89		Eom: / /	
Orbit: GEOSTATIONARY 140E	Apogee 35779 km	Perigee 35779km	Incl.: 0.0°	Repeat: Continuous	

GMS VISSR		Visible Infrared Spin-Scan Radiometer		RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:	
				Resolution	
				Swath	
GMSV-01	VISIBLE	0.500 -	0.7500um	1250.0 m	13000 km
GMSV-02	LWIR	10.500 -	12.500um	5000.0 m	13000 km

GOES 1-7		Geostationary Operational Environmental System			
Agency: NASA	Country: USA	loc: 02/26/87		Eom: / /	
Orbit: GEOSTATIONARY 76W	Apogee 35830 km	Perigee 35830km	Incl.: 0.0°	Repeat: Continuous	

VAS		VISSR and Atmospheric Sounder		RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:	
				Resolution	
				Swath	
IR-01	CO2 ABS	14.600 -	14.810um	13800.0 m	13000 km
IR-02	CO2 ABS	14.290 -	14.620um	13800.0 m	13000 km
IR-03	CO2 ABS	14.060 -	14.390um	13800.0 m	13000 km
IR-04	LWIR	13.790 -	14.180um	13800.0 m	13000 km
IR-05	LWIR	13.120 -	13.480um	13800.0 m	13000 km
IR-06	MWIR	4.496 -	4.537um	13800.0 m	13000 km
IR-07	LWIR	12.500 -	12.820um	13800.0 m	13000 km
IR-08	LWIR	10.360 -	12.120um	13800.0 m	13000 km
IR-09	H2O ABS	7.143 -	7.353um	13800.0 m	13000 km
IR-10	H2O ABS	6.390 -	7.067um	13800.0 m	13000 km
IR-11	MWIR	4.386 -	4.484um	13800.0 m	13000 km
IR-12	H2O ABS	3.623 -	4.386um	13800.0 m	13000 km
V1	VISIBLE	0.550 -	0.700um	13800.0 m	13000 km

VISSR		Visible Infrared Spin-Scan Radiometer		RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:	
				Resolution	
				Swath	
IR	LWIR	10.500 -	12.600um	9000.0 m	13000 km
VIS	VISIBLE	0.550 -	0.700um	13800.0 m	13000 km

GOES 8-9		Geostationary Operational Environmental System IM			
Agency: NASA	Country: USA	loc: / /		Eom: / /	
Orbit: GEOSTATIONARY 75W 135W	Apogee 35770 km	Perigee 35770km	Incl.: 0.0°	Repeat: Continuous	

GVAR I-M		GOES Variable Imaging Radiometer		RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:	
				Resolution	
				Swath	
GVAR-IM-1	VISIBLE	0.550 -	0.750um	1000.0 m	13000 km
GVAR-IM-2	MWIR	3.800 -	4.000um	4000.0 m	13000 km
GVAR-IM-3	H2OABS	6.500 -	7.000um	8000.0 m	13000 km
GVAR-IM-4	LWIR	10.200 -	11.200um	4000.0 m	13000 km
GVAR-IM-5	LWIR	11.500 -	12.500um	4000.0 m	13000 km

Sounder		GVAR 19-Channel Discrete-Filter Radiometer		RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:	
				Resolution	
				Swath	

**Appendix A, All Satellites**

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GVAR-DFR01	LWIR	14.710	-	14.710um	8700.0 m	13000 km
GVAR-DFR02	LWIR	14.370	-	14.370um	8700.0 m	13000 km
GVAR-DFR03	LWIR	14.060	-	14.060um	8700.0 m	13000 km
GVAR-DFR04	LWIR	13.960	-	13.960um	8700.0 m	13000 km
GVAR-DFR05	LWIR	13.370	-	13.370um	8700.0 m	13000 km
GVAR-DFR06	LWIR	12.660	-	12.660um	8700.0 m	13000 km
GVAR-DFR07	LWIR	12.020	-	12.020um	8700.0 m	13000 km
GVAR-DFR08	LWIR	11.030	-	11.030um	8700.0 m	13000 km
GVAR-DFR09	LWIR	9.710	-	9.710um	8700.0 m	13000 km
GVAR-DFR10	H20ABS	7.430	-	7.430um	8700.0 m	13000 km
GVAR-DFR11	H20ABS	7.020	-	7.020um	8700.0 m	13000 km
GVAR-DFR12	H20ABS	6.510	-	6.510um	8700.0 m	13000 km
GVAR-DFR13	MWIR	4.570	-	4.570um	8700.0 m	13000 km
GVAR-DFR14	MWIR	4.520	-	4.520um	8700.0 m	13000 km
GVAR-DFR15	MWIR	4.450	-	4.450um	8700.0 m	13000 km
GVAR-DFR16	MWIR	4.130	-	4.130um	8700.0 m	13000 km
GVAR-DFR17	MWIR	3.980	-	3.980um	8700.0 m	13000 km
GVAR-DFR18	MWIR	3.740	-	3.740um	8700.0 m	13000 km
GVAR-DFR19	VISIBLE	0.700	-	0.700um	8700.0 m	13000 km

<b>GOMS Geostationary Operational Meteorological Satellite</b>						
Agency: RSA	Country: RUSSIA	loc: 04/30/94		Eom: //		
Orbit: GEOSTATIONARY 76 E	Apogee 36000 km	Perigee 36000km	Incl.: 0.0°	Repeat: Continuous		

<b>STR</b>	<b>Scanning TV Radiometer</b>				<b>RAD</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution		Swath
STR-1	VISIBLE	0.400	-	0.700um	1500.0 m	1350 km
STR-2	LWIR	10.500	-	12.500um	8000.0 m	1350 km

<b>INSAT 1B/C/D Indian National Satellite System</b>						
Agency: ISRO	Country: INDIA	loc: 08/30/83		Eom: //		
Orbit: GEOSTATIONARY 74 E	Apogee 36000 km	Perigee 36000km	Incl.: 0.0°	Repeat: Continuous		

<b>VHRR I</b>	<b>Very High Resolution Radiometer</b>				<b>ISRO MSI</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution		Swath
VHRR-IR	LWIR	10.500	-	12.500um	11000.0 m	0 km
VHRR-V	VISIBLE	0.550	-	0.750um	2750.0 m	0 km

<b>INSAT 2 A/B Indian National Satellite System</b>						
Agency: ISRO	Country: INDIA	loc: 07/09/92		Eom: //		
Orbit: GEOSATIONARY 74 E	Apogee 36000 km	Perigee 36000km	Incl.: 0.0°	Repeat: Continuous		

<b>VHRR II</b>	<b>Very High Resolution Radiometer II</b>				<b>ISRO MSI</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution		Swath
VHRR-IR	LWIR	10.500	-	12.500um	8000.0 m	0 km
VHRR-V	VISIBLE	0.550	-	0.750um	2000.0 m	0 km

<b>IRS-A Indian Resources Satellite A</b>						
Agency: ISRO	Country: INDIA	loc: 01/01/88		Eom: //		
Orbit: SUN SYNCHRONOUS	Apogee 904 km	Perigee 904km	Incl.: 99.5°	Repeat: 22 Days		

<b>LISS-1</b>	<b>Linear Self Scanning Sensor 1</b>				<b>MSI</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution		Swath
LISS-1A	BLUE	0.450	-	0.520um	72.0 m	148 km
LISS-1B	GREEN	0.520	-	0.590um	72.0 m	148 km
LISS-1C	RED	0.620	-	0.680um	72.0 m	148 km

**Appendix A, All Satellites**

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LISS-1D	NIR	0.770 -	0.860um	72.0 m	148 km
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<b>IRS-B Indian Resources Satellite B</b>					
Agency: ISRO	Country: INDIA	loc: 01/01/91		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	900 km	Perigee	900km	Incl.: 99.5° Repeat: 22 Days

<b>LISS-2 Linear Self Scanning Sensor 2</b>					
Stereo Capability:			Off Axis Repeat:		
Band(s)				Resolution	Swath
LISS-2A	BLUE	0.450 -	0.520um	36.0 m	74 km
LISS-2B	GREEN	0.520 -	0.590um	36.0 m	74 km
LISS-2C	RED	0.620 -	0.680um	36.0 m	74 km
LISS-2D	NIR	0.770 -	0.860um	36.0 m	74 km

<b>IRS-C/D Indian Resources Satellite C &amp; D</b>					
Agency: ISRO	Country: INDIA	loc: 01/30/94		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	900 km	Perigee	900km	Incl.: 99.5° Repeat: 5-24 Days

<b>LISS-3 Linear Self Scanning Sensor 3</b>					
Stereo Capability:			Off Axis Repeat:		
Band(s)				Resolution	Swath
LISS-3A	GREEN	0.520 -	0.590um	20.0 m	140 km
LISS-3B	RED	0.620 -	0.680um	20.0 m	140 km
LISS-3C	NIR	0.770 -	0.860um	20.0 m	140 km
LISS-3D	SWIR	1.550 -	1.700um	70.0 m	140 km
LISS-3PAN	VISIBLE	0.500 -	0.750um	10.0 m	70 km

<b>WIFS Wide Field Sensor</b>					
Stereo Capability:			Off Axis Repeat:		
Band(s)				Resolution	Swath
WIFS-1	RED	0.620 -	0.680um	188.0 m	740 km
WIFS-2	NIR	0.770 -	0.860um	188.0 m	740 km

<b>IRS-P2 Indian Resources Satellite P2</b>					
Agency: ISRO DLR	Country: INDIA GERMANY	loc: 01/01/95		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	817 km	Perigee	817km	Incl.: 98.0° Repeat:

<b>LISS-2 Linear Self Scanning Sensor 2</b>					
Stereo Capability:			Off Axis Repeat:		
Band(s)				Resolution	Swath
LISS-2A	BLUE	0.450 -	0.520um	36.0 m	74 km
LISS-2B	GREEN	0.520 -	0.590um	36.0 m	74 km
LISS-2C	RED	0.620 -	0.680um	36.0 m	74 km
LISS-2D	NIR	0.770 -	0.860um	36.0 m	74 km

<b>MOS Multispectral Optoelectric Scanner</b>					
Stereo Capability:			Off Axis Repeat:		
Band(s)				Resolution	Swath
OMOS-C-2	SWIR	2.300 -	um	1500.0 m	195 km
MOS-A-01	NIR	0.7560 -	0.7574um	5800.0 m	200 km
MOS-A-02	NIR	0.7599 -	0.7613um	5800.0 m	200 km
MOS-A-03	NIR	0.7628 -	0.7642um	5800.0 m	200 km
MOS-A-04	NIR	0.7657 -	0.7671um	5800.0 m	200 km
MOS-B-01	BLUE	0.403 -	0.413um	1500.0 m	195 km
MOS-B-02	BLUE	0.438 -	0.448um	1500.0 m	195 km
MOS-B-03	BLUEGREEN	0.480 -	0.490um	1500.0 m	195 km
MOS-B-04	GREEN	0.515 -	0.525um	1500.0 m	195 km
MOS-B-05	GREEN	0.565 -	0.575um	1500.0 m	195 km
MOS-B-06	RED	0.610 -	0.620um	1500.0 m	195 km
MOS-B-07	RED	0.645 -	0.655um	1500.0 m	195 km



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MOS-B-08	RED	0.680 -	0.690um	1500.0 m	195 km
MOS-B-09	NIR	0.745 -	0.755um	1500.0 m	195 km
MOS-B-10	NIR	0.810 -	0.820um	1500.0 m	195 km
MOS-B-11	NIR	0.875 -	0.885um	1500.0 m	195 km
MOS-B-12	NIR	0.940 -	0.950um	1500.0 m	195 km
MOS-B-13	NIR	1.005 -	1.010um	1500.0 m	195 km
MOS-G-01	SWIR	1.600 -	um	1500.0 m	195 km

<b>ITOS-1 Improved TIROS Operational System</b>					
Agency: NASA	Country: USA	loc: 02/28/70		Eom: / /	
Orbit: POLAR	Apogee	920 km	Perigee	890km	Incl.: 102.0° Repeat: Daily

**VHRR Very High Resolution Radiometer MSI**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
VHRR-1	RED	0.600 -	0.700um	800.0 m	2580 km
VHRR-2	LWIR	10.500 -	12.500um	800.0 m	2580 km

<b>JERS-1 Japanese-Earth Resources Satellite</b>					
Agency: NASDA	Country: JAPAN	loc: 02/11/92		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	568 km	Perigee	568km	Incl.: 97.7° Repeat: 44 Days

**JERS-SAR JERS Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
L-SAR	L-BAND	1.275 -	GHz HH	18.0 m	75 km

**OPS JERS Optical Sensor MSI**

Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)				Resolution	Swath
SWIR-1	SWIR	1.600 -	1.700um	18.0 m	75 km
SWIR-2	SWIR	2.050 -	2.150um	18.0 m	75 km
SWIR-3	SWIR	2.150 -	2.250um	18.0 m	75 km
SWIR-4	SWIR	2.200 -	2.400um	18.0 m	75 km
VNIR 1	GREEN	0.520 -	0.600um	18.0 m	150 km
VNIR 2	RED	0.630 -	0.690um	18.0 m	150 km
VNIR 3	NIR	0.760 -	0.860um Nadir Stereo	18.0 m	150 km
VNIR 4	NIR	0.760 -	0.860um Forward Stereo	18.0 m	75 km

<b>LANDSAT4/5 Land Satellite</b>					
Agency: EOSAT	Country: USA	loc: 01/01/82		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	705 km	Perigee	705km	Incl.: 98.2° Repeat: 16 Days

**MSS Multispectral Scanner MSI**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
MSS-1	GREEN	0.500 -	0.600um	80.0 m	185 km
MSS-2	RED	0.600 -	0.700um	80.0 m	185 km
MSS-3	NIR	0.700 -	0.800um	80.0 m	185 km
MSS-4	NIR	0.800 -	11.000um	80.0 m	185 km

**TM Thematic Mapper MSI**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
TM-1	BLUEGREEN	0.450 -	0.520um	30.0 m	185 km
TM-2	GREEN	0.520 -	0.600um	30.0 m	185 km
TM-3	RED	0.630 -	0.690um	30.0 m	185 km
TM-4	NIR	0.760 -	0.900um	30.0 m	185 km
TM-5	SWIR	1.550 -	1.750um	30.0 m	185 km
TM-6	LWIR	10.400 -	12.500um	120.0 m	185 km

TM-7	SWIR	2.080 -	2.350 um	30.0 m	185 km
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<b>METEOR-3</b>						<b>Low Earth Orbiting Meteorological Satellite Series</b>					
Agency: PLANETA			Country: RUSSIA			loc: 10/24/85			Eom: / /		
Orbit: POLAR		Apogee		1250 km Perigee		1200 km		Incl.: 82.5°		Repeat: Daily	

<b>MR-2000M</b>						<b>TV Camera System</b>						<b>CAM</b>					
Stereo Capability:						Off Axis Repeat:											
Band(s)						Resolution		Swath									
MR-2000	VISIBLE	0.500 -	0.700 um	TV		1400.0 m		3100 km									

<b>MR-900B</b>						<b>TV Camera System</b>						<b>CAM</b>					
Stereo Capability:						Off Axis Repeat:											
Band(s)						Resolution		Swath									
MR-900B	VISIBLE	0.500 -	0.700 um	TV		2000.0 m		3100 km									

<b>SCARAB</b>						<b>Scanner for the Radiation Budget</b>						<b>RAD</b>					
Stereo Capability:						Off Axis Repeat:											
Band(s)						Resolution		Swath									
SCARAB1	UV LWIR	0.200 -	50.000 um			60000.0 m		3000 km									
SCARAB2	UV MWIR	0.200 -	4.000 um			60000.0 m		3000 km									
SCARAB3	VISIBLE	0.500 -	0.700 um			60000.0 m		3000 km									
SCARAB4	LWIR	10.500 -	12.500 um			60000.0 m		3000 km									

<b>SM</b>						<b>Multi-channel Spectrometer</b>						<b>SPEC</b>					
Stereo Capability:						Off Axis Repeat:											
Band(s)						Resolution		Swath									
SM-01	CO2 ABS	9.650 -	um			42000.0 m		1000 km									
SM-02	LWIR	10.600 -	um			42000.0 m		1000 km									
SM-03	LWIR	11.100 -	um			42000.0 m		1000 km									
SM-04	LWIR	13.330 -	um			42000.0 m		1000 km									
SM-05	LWIR	13.700 -	um			42000.0 m		1000 km									
SM-06	LWIR	14.250 -	um			42000.0 m		1000 km									
SM-07	LWIR	14.430 -	um			42000.0 m		1000 km									
SM-08	LWIR	14.750 -	um			42000.0 m		1000 km									
SM-09	LWIR	15.015 -	um			42000.0 m		1000 km									
SM-10	LWIR	18.700 -	um			42000.0 m		1000 km									

<b>TOMS-M</b>						<b>Total Ozone Mapping Spectrometer</b>						<b>SPEC</b>					
Stereo Capability:						Off Axis Repeat:											
Band(s)						Resolution		Swath									
TOMS-1	UV	0.3125 -	um			47.0 m		3100 km									
TOMS-2	UV	0.3175 -	um			47.0 m		3100 km									
TOMS-3	UV	0.3313 -	um			47.0 m		3100 km									
TOMS-4	UV	0.3398 -	um			47.0 m		3100 km									
TOMS-5	UV	0.3600 -	um			47.0 m		3100 km									
TOMS-6	UV	0.3800 -	um			47.0 m		3100 km									

<b>MOS-1</b>						<b>Marine Observation Satellite</b>					
Agency: NASDA			Country: JAPAN			loc: 02/07/90			Eom: / /		
Orbit: SUN SYNCHRONOUS		Apogee		908 km Perigee		908 km		Incl.: 99.1°		Repeat: 44 Days	

<b>MESSR</b>						<b>Multispectrum Electronic Self Scanning Radiometer</b>						<b>MSI</b>					
Stereo Capability:						Off Axis Repeat:											
Band(s)						Resolution		Swath									
MESSR-1	GREEN	0.510 -	0.610 um			50.0 m		100 km									
MESSR-2	RED	0.610 -	0.710 um			50.0 m		100 km									
MESSR-3	NIR	0.710 -	0.810 um			50.0 m		100 km									
MESSR-4	NIR	0.810 -	1.100 um			50.0 m		100 km									

<b>MSR</b>		<b>Microwave Scanning Radiometer</b>				<b>MWR</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSR 1	KA-BAND	32.000 -	GHz	23000.0 m	1500 km	
MSR 2	K-BAND	22.000 -	GHz	32000.0 m	1500 km	
<b>VTIR</b>		<b>Visible &amp; Thermal Infrared Sensor</b>				<b>MSI</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
VTIR 1	LWIR	8.500 -	14.000um	2700.0 m	1500 km	
VTIR 2	LWIR	8.500 -	14.000um	2700.0 m	1500 km	
VTIR 3	LWIR	8.500 -	14.000um	2700.0 m	1500 km	
VTIR-VIS	VISIBLE	0.400 -	0.700um	900.0 m	1500 km	
<b>NIMBUS</b>		<b>NOAA Improved Bus Satellite NOAA-11</b>				
Agency: NOAA		Country: USA		loc: 10/24/78		Eom: / /
Orbit: SUN SYNCHRONOUS		Apogee	900 km	Perigee	98km	Incl.: 0.0° Repeat: Daily
<b>CZCS</b>		<b>Coastal Zone Color Scanner</b>				<b>MSI</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
CZCS-1	BLUE	0.430 -	0.450um	825.0 m	1600 km	
CZCS-2	GREEN	0.510 -	0.530um	825.0 m	1600 km	
CZCS-3	GREEN	0.540 -	0.560um	825.0 m	1600 km	
CZCS-4	RED	0.660 -	0.680um	825.0 m	1600 km	
CZCS-5	NIR	0.700 -	0.800um	825.0 m	1600 km	
CZCS-6	LWIR	10.500 -	12.500um	825.0 m	1600 km	
<b>ERB</b>		<b>Earth Radiation Budget Monitor</b>				<b>RAD</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
ERB	EMR	0.200 -	50.000um	500000.0 m	13000 km	
<b>LIMS</b>		<b>Limb Infrared Monitor of the Stratosphere</b>				<b>RAD</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
LIMS1	H2OABS	6.200 -	6.300um	500000.0 m	13000 km	
LIMS2	H2OABS	6.700 -	6.800um	500000.0 m	13000 km	
LIMS3	LWIR	9.600 -	9.700um	500000.0 m	13000 km	
LIMS4	LWIR	11.300 -	11.400um	500000.0 m	13000 km	
LIMS5	CO2ABS	15.200 -	15.300um	500000.0 m	13000 km	
LIMS6	CO2ABS	13.200 -	17.200um	500000.0 m	13000 km	
<b>SAMII</b>		<b>Stratospheric Aerosol Measurement II</b>				<b>RAD</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
SAMII	NIR	0.900 -	1.100um	500000.0 m	13000 km	
<b>SAMS</b>		<b>Stratospheric And Mesospheric Sounder</b>				<b>RAD</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
SAMS1	LWIR	4.100 -	15.000um	500000.0 m	13000 km	
SAMS2	LWIR	25.000 -	100.000um	500000.0 m	12000 km	
<b>SBUV/TOMS</b>		<b>Solar Backscatter Ultraviolet/Total Ozone Mapper</b>				<b>RAD</b>
Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
TOMS1	UV	0.250 -	0.380um	160000.0 m	13000 km	
TOMS2	UV	0.160 -	0.400um	160000.0 m	13000 km	

**SMMR Scanning Multichannel Microwave Radiometer MWR**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
SMMR-1	X-BAND	6.630 -	GHz	136000.0 m	600 km
SMMR-2	X-BAND	10.690 -	GHz	87000.0 m	600 km
SMMR-3	KU-BAND	18.000 -	GHz	57000.0 m	600 km
SMMR-4	K-BAND	21.000 -	GHz	44000.0 m	600 km
SMMR-5	Q-BAND	37.000 -	GHz	28000.0 m	600 km

**THIR Temperature Humidity Infrared Radiometer RAD**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
THIR	H2OABS	6.750 -	11.500 um	500000.0 m	13000 km

**RADARSAT****RADARSAT**

Agency: CSA Country: CANADA loc: 03/01/95 Eom: //  
 Orbit: SUN SYNCHRONOUS Apogee 800 km Perigee 800 km Incl.: 98.6° Repeat: 6 Days

**C-Band SAR RADARSAT, Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
EXTENDED-1	C-BAND	5.360 -	GHz HH Ext d1	19.0 m	75 km
EXTENDED-2	C-BAND	5.360 -	GHz HH Ext d2	28.0 m	170 km
FINE	C-BAND	5.360 -	GHz HH Fine	9.0 m	45 km
SCAN-1	C-BAND	5.360 -	GHz HH Scan1	50.0 m	305 km
SCAN-2	C-BAND	5.360 -	GHz HH Scan	100.0 m	510 km
STANDARD	C-BAND	5.360 -	GHz HH STD	25.0 m	100 km
WIDE-1	C-BAND	5.360 -	GHz HH Wide	28.0 m	165 km
WIDE-2	C-BAND	5.360 -	GHz HH Wide	25.0 m	150 km

**RESURS-01-3****Russian Earth Resource Satellite -O1 Series**

Agency: RSA Country: RUSSIA loc: 01/01/95 Eom: //  
 Orbit: SUN SYNCHRONOUS Apogee 660 km Perigee 660 km Incl.: 98.0° Repeat:

**MSU-E Multispectral Scanner of High Resolution MSI**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
MSU-E-1	GREEN	0.500 -	0.600 um	33.0 m	80 km
MSU-E-2	RED	0.600 -	0.700 um	33.0 m	80 km
MSU-E-3	NIR	0.800 -	0.900 um	33.0 m	80 km

**MSU-SK Multispectral Scanner of Mod Conical Scan MSI**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
MSU-SK-1	GREEN	0.500 -	0.600 um	170.0 m	600 km
MSU-SK-2	RED	0.600 -	0.700 um	170.0 m	600 km
MSU-SK-3	NIR	0.700 -	0.800 um	170.0 m	600 km
MSU-SK-4	NIR	0.800 -	1.100 um	170.0 m	600 km
MSU-SK-5	LWIR	10.400 -	12.600 um	600.0 m	600 km

**TRAVERS Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
TRAVERS	S-BAND	3.280 -	GHz	200.0 m	50 km

**RESURS-02****Russian Earth Resource Satellite -O2 Series**

Agency: RSA Country: RUSSIA loc: 02/01/94 Eom: //  
 Orbit: SUN SYNCHRONOUS Apogee 660 km Perigee 660 km Incl.: 98.0° Repeat:

**MSU-E Multispectral Scanner of High Resolution MSI**

Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSU-E-1	GREEN	0.500 -	0.600 um		33.0 m	80 km
MSU-E-2	RED	0.600 -	0.700 um		33.0 m	80 km
MSU-E-3	NIR	0.800 -	0.900 um		33.0 m	80 km

**MSU-SK Multispectral Scanner of Mod Conical Scan MSI**

Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSU-SK-1	GREEN	0.500 -	0.600 um		170.0 m	600 km
MSU-SK-2	RED	0.600 -	0.700 um		170.0 m	600 km
MSU-SK-3	NIR	0.700 -	0.800 um		170.0 m	600 km
MSU-SK-4	NIR	0.800 -	1.100 um		170.0 m	600 km
MSU-SK-5	LWIR	10.400 -	12.600 um		600.0 m	600 km

**RESURS-F Russian Earth Resource Satellite -F Series**

Agency: RSA Country: RUSSIA loc: 01/01/75 Eom: / /  
Orbit: POLAR Apogee 240 km Perigee 275 km Incl.: 82.3° Repeat: n/a

**KFA-1000 Camera System 1000mm CAM**

Band(s)		Stereo Capability: Fwd/Aft		Off Axis Repeat:	Resolution	Swath
KFA-1000-L	VNIR	0.570 -	0.800 um Left		5.0 m	120 km
KFA-1000-R	VNIR	0.570 -	0.800 um Right		5.0 m	120 km

**KFA-200 Camera System 200 mm CAM**

Band(s)		Stereo Capability: Fwd/Aft		Off Axis Repeat:	Resolution	Swath
KFA-200-1	GREEN	0.510 -	0.600 um		25.0 m	180 km
KFA-200-2	NIR	0.700 -	0.840 um		25.0 m	180 km
KFA-200-3	RED	0.600 -	0.700 um		25.0 m	180 km

**MK-4 4-Channel Camera System 300mm CAM**

Band(s)		Stereo Capability: Fwd/Aft		Off Axis Repeat:	Resolution	Swath
MK-4-1	RED	0.640 -	0.690 um		14.0 m	144 km
MK-4-2	NIR	0.810 -	0.860 um		14.0 m	144 km
MK-4-3	GREEN	0.515 -	0.565 um		14.0 m	144 km
MK-4-4	BLUEGREEN	0.460 -	0.510 um		14.0 m	144 km
MK-4-5	RED	0.610 -	0.750 um		14.0 m	144 km
MK-4-6	VISIBLE	0.435 -	0.680 um		14.0 m	144 km

**RESURS-O Russian Earth Resource Satellite -O Series**

Agency: RSA Country: RUSSIA loc: 03/10/85 Eom: / /  
Orbit: SUN SYNCHRONOUS Apogee 660 km Perigee 660 km Incl.: 98.0° Repeat: n/a

**MSU-E Multispectral Scanner of High Resolution MSI**

Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSU-E-1	GREEN	0.500 -	0.600 um		33.0 m	80 km
MSU-E-2	RED	0.600 -	0.700 um		33.0 m	80 km
MSU-E-3	NIR	0.800 -	0.900 um		33.0 m	80 km

**MSU-SK Multispectral Scanner of Mod Conical Scan MSI**

Band(s)		Stereo Capability:		Off Axis Repeat:	Resolution	Swath
MSU-SK-1	GREEN	0.500 -	0.600 um		170.0 m	600 km
MSU-SK-2	RED	0.600 -	0.700 um		170.0 m	600 km
MSU-SK-3	NIR	0.700 -	0.800 um		170.0 m	600 km
MSU-SK-4	NIR	0.800 -	1.100 um		170.0 m	600 km

**Appendix A, All Satellites**

09/30/94

MSU-SK-5	LWIR	10.400 -	12.600um	600.0 m	600 km
<b>TRIVERS</b>		<b>Synthetic Aperture Radar</b>			SAR
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
TRIVERS	S-BAND	3.280 -	GHz	200.0 m	50 km

<b>SEASAT</b>		<b>Sea Satellite</b>			
Agency: NOAA	Country: USA	loc: 07/07/78	Eom: 10/09/78		
Orbit: ELLIPTICAL	Apogee 800 km	Perigee 776 km	Incl.: 108.0°	Repeat: n/a	

<b>SASS</b>		<b>Seasat Active Scatterometer System</b>			SCAT
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
SS SASS	KU-BAND	14.600 -	GHz	50000.0 m	1000 km

<b>SEASAT VIR</b>		<b>Seasat Visible Near Infrared Sensor</b>			MSI
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
VIR-1	VISNIR	0.470 -	0.940um	2000.0 m	2280 km
VIR-2	LWIR	10.500 -	12.500um	4000.0 m	2280 km

<b>SEASAT-SAR</b>		<b>Seasat Synthetic Aperture Radar</b>			SAR
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
SEASAT-SAR	L-BAND	1.350 -	GHz HH	25.0 m	100 km

<b>SMMR</b>		<b>Scanning Multichannel Microwave Radiometer</b>			MWR
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
SMMR-1	X-BAND	6.630 -	GHz	136000.0 m	600 km
SMMR-2	X-BAND	10.690 -	GHz	87000.0 m	600 km
SMMR-3	KU-BAND	18.000 -	GHz	57000.0 m	600 km
SMMR-4	K-BAND	21.000 -	GHz	44000.0 m	600 km
SMMR-5	Q-BAND	37.000 -	GHz	28000.0 m	600 km

<b>SEASTAR</b>		<b>Sea Star S/C</b>			
Agency: NASA	Country: USA	loc: 07/30/94	Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee 705 km	Perigee 705 km	Incl.: 98.2°	Repeat: 2 Days	

<b>SeaWIFS</b>		<b>Sea Wide Field Sensor</b>			MSI
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
SEAWIFS-1	BLUE	0.402 -	0.422um	1130.0 m	2800 km
SEAWIFS-2	BLUE	0.433 -	0.543um	1130.0 m	2800 km
SEAWIFS-3	BLUE	0.480 -	0.500um	1130.0 m	2800 km
SEAWIFS-4	GREEN	0.500 -	0.520um	1130.0 m	2800 km
SEAWIFS-5	GREEN	0.545 -	0.565um	1130.0 m	2800 km
SEAWIFS-6	RED	0.660 -	0.680um	1130.0 m	2800 km
SEAWIFS-7	NIR	0.745 -	0.785um	1130.0 m	2800 km
SEAWIFS-8	NIR	0.845 -	0.885um	1130.0 m	2800 km

<b>SMS 1&amp;2</b>		<b>Synchronous Meteorological Satellite</b>			
Agency: NOAA	Country: USA	loc: 06/27/74	Eom: / /		
Orbit: GEOSTATIONARY 76E135W	Apogee 35830 km	Perigee 35830 km	Incl.: 0.0°	Repeat: Continous	

<b>VISSR</b>		<b>Visible Infrared Spin-Scan Radiometer</b>			RAD
		Stereo Capability:		Off Axis Repeat:	
Band(s)				Resolution	Swath
IR	LWIR	10.500 -	12.600um	9000.0 m	13000 km
VIS	VISIBLE	0.550 -	0.700um	13800.0 m	13000 km

SPOT 1 & 2		Satellite Probatoire de l'Observation de la Terre				
Agency: CNES	Country: FRANCE	loc: 01/01/86		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	832 km	Perigee	832 km	Incl.: 98.7° Repeat: 26 Days	

**HRV** **High Resolution Visible Sensor** **E-O MSI**  
Stereo Capability: Cross Track Off Axis Repeat: 2 Days

Band(s)					Resolution	Swath
HRV PAN	VISIBLE	0.510 -	0.730 um	Stereo	10.0 m	60 km
HRV-1	GREEN	0.500 -	0.590 um		20.0 m	60 km
HRV-2	RED	0.610 -	0.680 um		20.0 m	60 km
HRV-3	NIR	0.790 -	0.890 um		20.0 m	60 km

SPOT 3		Satellite Probatoire de l'Observation de la Terre				
Agency: CNES	Country: FRANCE	loc: 09/26/93		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	832 km	Perigee	832 km	Incl.: 98.7° Repeat: 26 Days	

**HRV** **High Resolution Visible Sensor** **E-O MSI**  
Stereo Capability: Cross Track Off Axis Repeat: 2 Days

Band(s)					Resolution	Swath
HRV PAN	VISIBLE	0.510 -	0.730 um	Stereo	10.0 m	60 km
HRV-1	GREEN	0.500 -	0.590 um		20.0 m	60 km
HRV-2	RED	0.610 -	0.680 um		20.0 m	60 km
HRV-3	NIR	0.790 -	0.890 um		20.0 m	60 km

**POAM-II** **Polar Ozone and Aerosol Measurement II** **PDET**  
Stereo Capability: Off Axis Repeat:

Band(s)					Resolution	Swath
POAM 1	UV	0.350 -	0.355 um	Vertical limb	600.0 m	0 km
POAM 2	BLUE	0.441 -	0.443 um	Vertical limb	600.0 m	0 km
POAM 3	BLUEGREEN	0.447 -	0.449 um	Vertical limb	600.0 m	0 km
POAM 4	RED	0.593 -	0.608 um	Vertical limb	600.0 m	0 km
POAM 5	NIR	0.760 -	0.762 um	Vertical limb	600.0 m	0 km
POAM 6	NIR	0.773 -	0.880 um	Vertical limb	600.0 m	0 km
POAM 7	NIR	0.919 -	0.921 um	Vertical limb	600.0 m	0 km
POAM 8	NIR	0.935 -	0.937 um	Vertical limb	600.0 m	0 km
POAM 9	NIR	1.054 -	10.064 um	Vertical limb	600.0 m	0 km

SPOT 4		Satellite Probatoire de l'Observation de la Terre				
Agency: CNES	Country: FRANCE	loc: 01/01/97		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	832 km	Perigee	832 km	Incl.: 98.7° Repeat: 26 Days	

**HRVIR** **High Resolution Visible and Infrared Sensor** **E-O MSI**  
Stereo Capability: Cross Track Off Axis Repeat: 2 Days

Band(s)					Resolution	Swath
HRVIR-1	BLUEGREEN	0.430 -	0.470 um		20.0 m	85 km
HRVIR-2	GREEN	0.500 -	0.590 um		20.0 m	85 km
HRVIR-3	RED	0.610 -	0.680 um		10.0 m	85 km
HRVIR-4	NIR	0.780 -	0.890 um		20.0 m	85 km
HRVIR-5	SWIR	1.580 -	1.750 um		20.0 m	85 km
HRVIR-PAN	VISIBLE	.0510 -	0.730 um		10.0 m	85 km

**VEGETATION** **Vegetation Sensor** **RAD**  
Stereo Capability: Off Axis Repeat:

Band(s)					Resolution	Swath
VEG1	VNIR	-			1100.0 m	2200 km

SSR1		Satellite de Sensolamento Remoto				
Agency: INPE	Country: BRAZIL	loc: 01/01/97		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	640 km	Perigee	640 km	Incl.: 0.0° Repeat:	

WFI		Wide Field Imager			MSI	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
WFI-1	RED	0.630 -	0.690um	260.0 m	856 km	
WFI-2	NIR	0.770 -	0.890um	260.0 m	856 km	

TIROS-N		Television InfraRed Observation System				
Agency: NOAA	Country: USA	loc: 04/01/60		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee 850 km	Perigee 800km	Incl.: 99.0°	Repeat: Daily		

AVHRR		Advanced Very High Resolution Radiometer			MSI	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
AVHRR-1	RED	0.580 -	0.680um	1100.0 m	2700 km	
AVHRR-2	NIR	0.720 -	1.100um	1100.0 m	2700 km	
AVHRR-2A	NIR	0.820 -	0.870um	1100.0 m	2700 km	
AVHRR-3	MWIR	3.550 -	3.930um	1100.0 m	2700 km	
AVHRR-3A	SWIR	1.570 -	1.780um	1100.0 m	2700 km	
AVHRR-4	LWIR	10.300 -	11.300um	1100.0 m	2700 km	
AVHRR-5	LWIR	11.500 -	12.500um	1100.0 m	2700 km	

TOV HIRS/2		TIROS Operational Vehicle Sound HIRes IR Spectrometer			RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
HIRS 01-05	LWIR	13.970 -	14.950um	17400.0 m	1120 km	
HIRS 06-07	LWIR	13.350 -	13.640um	17400.0 m	1120 km	
HIRS 08	LWIR	11.110 -	11.110um	17400.0 m	1120 km	
HIRS 09	LWIR	9.710 -	9.710um	17400.0 m	1120 km	
HIRS 10-12	LWIR	6.720 -	8.160um	17400.0 m	1120 km	
HIRS 13-17	MWIR	4.240 -	4.570um	17400.0 m	1120 km	
HIRS 18-20	VISNIR	0.690 -	4.000um	17400.0 m	1120 km	

TOV MSU		TIROS Operational Vehicle Sound Microwave Sounding Unit			MWR	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
TOVS MSU 1	V-BAND	50.310 -	um	105000.0 m	2320 km	
TOVS MSU 2	V-BAND	50.730 -	GHz	105000.0 m	2320 km	
TOVS MSU 3	V-BAND	54.960 -	GHz	105000.0 m	2320 km	
TOVS MSU 4	W-BAND	54.950 -	GHz	105000.0 m	2320 km	

TOV SSU		TIROS Operational Vehicle Stratospheric Sounding Unit			MWR	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
SSU	LWIR	9.000 -	15.000um	147300.0 m	1473 km	

TRMM		Tropical Rainfall Measuring Mission				
Agency: NASDA NASA	Country: JAPAN USA	loc: 08/01/97		Eom: / /		
Orbit: CIRCULAR	Apogee 370 km	Perigee 370km	Incl.: 35.0°	Repeat:		

CERES		Clouds & Earth's Radiant Energy System			RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
CERES-1	VNIR LWIR	0.300 -	50.000um	Total Radiance	21000.0 m	13000 km
CERES-2	VNIR MWIR	0.300 -	5.000um	Shortwave	21000.0 m	13000 km
CERES-3	LWIR	8.000 -	14.000um	Longwave	21000.0 m	13000 km

LIS		Lightening Imaging Sensor			RAD	
Band(s)		Stereo Capability:		Off Axis Repeat:		
				Resolution	Swath	
LIS	NIR	0.777 -	um	8500.0 m	600 km	



<b>PR</b>		<b>Precipitation Radar</b>				<b>SCAT</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
PR-1	KU-BAND	13.796 -	GHz H	4300.0 m		220 km	
PR-2	KU-BAND	13.802 -	GHz H	4300.0 m		220 km	

<b>TMI</b>		<b>TRMM Microwave Imager</b>				<b>MWR</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
TMI-1	X-BAND	10.700 -	GHz	4400.0 m		790 km	
TMI-2	K-BAND	19.400 -	GHz	9100.0 m		790 km	
TMI-3	K-BAND	21.300 -	GHz	10500.0 m		790 km	
TMI-4	Q-BAND	37.000 -	GHz	18500.0 m		790 km	
TMI-5	W-BAND	85.500 -	GHz	45000.0 m		790 km	

<b>VIRS</b>		<b>Visible InfraRed Scanner</b>				<b>RAD</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
VIRS-1	RED	0.630 -	um	2000.0 m		720 km	
VIRS-2	SWIR	1.600 -	um	2000.0 m		720 km	
VIRS-3	MWIR	3.750 -	um	2000.0 m		720 km	
VIRS-4	LWIR	10.800 -	um	2000.0 m		720 km	
VIRS-5	LWIR	12.00 -	um	2000.0 m		720 km	

<b>UARS</b>		<b>Upper Atmosphere Research Satellite</b>					
Agency: NASA	Country: USA	loc: 09/13/91		Eom: / /			
Orbit: CIRCULAR	Apogee 600 km	Perigee 600 km	Incl.: 57.0°	Repeat:			

<b>SOLSTICE</b>		<b>Solar Stellar Irradiance Comparison Experiment</b>				<b>RAD</b>	
Band(s)		Stereo Capability:		Off Axis Repeat:		Resolution	
SOL 1-5	UV	0.005 -	.440 um	5 Channels	1300000.0 m		130000 km

<b>WorldView</b>		<b>World View Imaging Corp</b>					
Agency: CIV	Country: USA	loc: 12/31/95		Eom: / /			
Orbit: SUN SYNCHRONOUS	Apogee 475 km	Perigee 475 km	Incl.: 98.0°	Repeat: 120 Days			

<b>WV-MSS</b>		<b>WorldView Multispectral Scanner</b>				<b>MSI</b>	
Band(s)		Stereo Capability:		Off Axis Repeat: 2 Days		Resolution	
WV-1	GREEN	0.600 -	0.600 um	15.0 m		900 km	
WV-2	RED	0.610 -	0.680 um	15.0 m		900 km	
WV-3	NIR	0.790 -	0.890 um	15.0 m		900 km	

<b>WV-Stereo</b>		<b>WorldView Stereo Sensor</b>				<b>E-O</b>	
Band(s)		Stereo Capability: Fwd/Aft		Off Axis Repeat:		Resolution	
WV-PAN	VISIBLE	0.450 -	0.800 um	3.0 m		36 km	

**Appendix B: Database Listing Satellite Synthetic Aperture Radars**

ALMAZ-1		ALMAZ-1 S/C SARSAT			
Agency: RSA	Country: RUSSIA	loc: 03/31/91		Eom: / /	
Orbit: POLAR	Apogee	300 km	Perigee	360 km	Incl.: 72.7° Repeat: n/a

MAZ-1		ALMAZ-1, Synthetic Aperture Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
S-SAR	S-BAND	3.125 -	GHz	10.0 m	40 km

ALMAZ-1B		ALMAZ-1B, Earth Remote Sensing Satellite			
Agency: RSA	Country: RUSSIA	loc: 12/31/96		Eom: / /	
Orbit: POLAR	Apogee	400 km	Perigee	400 km	Incl.: 73.0° Repeat: Variable

SAR-10		ALMAZ-1B, Synthetic Aperture S-Band Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
SAR-10	S-BAND	3.130 -	GHz	VV,HH,	5.0 m
SAR-10	S-BAND	3.130 -	GHz	VV,HH,	15.0 m
SAR-10	S-BAND	3.130 -	GHz	VV,HH,	15.0 m

SAR-3		ALMAZ-1B, Synthetic Aperture X-Band Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
SAR-3	X-BAND	8.600 -	GHz	VV	5.0 m

SAR-70		ALMAZ-1B, Synthetic Aperture P-Band Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
SAR-70	P-BAND	43.00 -	MHz	VV,HH,	22.0 m

COSMOS 1870		COSMOS 1870, ALMAZ Prototype, USSR			
Agency: RSA	Country: RUSSIA	loc: 07/25/87		Eom: 07/30/89	
Orbit: CIRCULAR	Apogee	275 km	Perigee	275 km	Incl.: 73.0° Repeat: n/a

S-Band SAR		COSMOS 1870, Synthetic Aperture Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
SAR-1870	S-BAND	3.125 -	GHz	VV	25.0 m

ERS-1		European Remote Sensing Satellite 1			
Agency: ESA	Country: EUROPEAN	loc: 07/17/91		Eom: / /	
Orbit: CIRCULAR	Apogee	610 km	Perigee	610 km	Incl.: 57.0° Repeat: 35 Days

ERS-AMI		ERS Synthetic Aperture Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
ERS-AMI1	C-BAND	5.360 -	GHz	VV Image	30.0 m
ERS-AMI2	C-BAND	5.360 -	GHz	LV Wave	30.0 m

ERS-2		European Remote Sensing Satellite 2			
Agency: ESA	Country: EUROPEAN	loc: 12/31/94		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee	824 km	Perigee	824 km	Incl.: 0.0° Repeat:

ERS-AMI		ERS Synthetic Aperture Radar			SAR
Band(s)		Stereo Capability:		Off Axis Repeat:	
ERS-AMI1	C-BAND	5.360 -	GHz	VV Image	30.0 m
ERS-AMI2	C-BAND	5.360 -	GHz	LV Wave	30.0 m

<b>JERS-1 Japanese-Earth Resources Satellite</b>						
Agency: NASDA	Country: JAPAN	loc: 02/11/92		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	568 km	Perigee	568 km	Incl.: 97.7°	Repeat: 44 Days

**JERS-SAR JERS Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
L-SAR L-BAND 1.275 - GHz HH	18.0 m	75 km

<b>RADARSAT RADARSAT</b>						
Agency: CSA	Country: CANADA	loc: 03/01/95		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	800 km	Perigee	800 km	Incl.: 98.6°	Repeat: 6 Days

**C-Band SAR RADARSAT, Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
EXTENDED-1 C-BAND 5.360 - GHz HH Extd1	19.0 m	75 km
EXTENDED-2 C-BAND 5.360 - GHz HH Extd2	28.0 m	170 km
FINE C-BAND 5.360 - GHz HH Fine	9.0 m	45 km
SCAN-1 C-BAND 5.360 - GHz HH Scan1	50.0 m	305 km
SCAN-2 C-BAND 5.360 - GHz HH Scan	100.0 m	510 km
STANDARD C-BAND 5.360 - GHz HH STD	25.0 m	100 km
WIDE-1 C-BAND 5.360 - GHz HH Wide	28.0 m	165 km
WIDE-2 C-BAND 5.360 - GHz HH Wide	25.0 m	150 km

<b>RESURS-01-3 Russian Earth Resource Satellite -O1 Series</b>						
Agency: RSA	Country: RUSSIA	loc: 01/01/95		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	660 km	Perigee	660 km	Incl.: 98.0°	Repeat:

**TRIVERS Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
TRIVERS S-BAND 3.280 - GHz	200.0 m	50 km

<b>RESURS-O Russian Earth Resource Satellite -O Series</b>						
Agency: RSA	Country: RUSSIA	loc: 03/10/85		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee	660 km	Perigee	660 km	Incl.: 98.0°	Repeat: n/a

**TRIVERS Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
TRIVERS S-BAND 3.280 - GHz	200.0 m	50 km

<b>SEASAT Sea Satellite</b>						
Agency: NOAA	Country: USA	loc: 07/07/78		Eom: 10/09/78		
Orbit: ELLIPTICAL	Apogee	800 km	Perigee	776 km	Incl.: 108.0°	Repeat: n/a

**SEASAT-SAR Seasat Synthetic Aperture Radar SAR**

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SEASAT-SAR L-BAND 1.350 - GHz HH	25.0 m	100 km

**Appendix C: Database Listing Satellite Sensor With Resolution Better Than 30m.**

**Appendix C. All Imaging Satellites with Resolution Better than 30 Meters**

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<b>ADEOS</b>		<b>Advanced Earth Observing Satellite</b>			
Agency: NASDA	Country: JAPAN	loc: 01/01/96		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee 800 km	Perigee 800km	Incl.: 98.6°	Repeat: 41 days	

**AVNIR** **Advanced Visible & Near Infrared Radiometer** **MSI**  
 Stereo Capability: Cross Track Off Axis Repeat: 1 Day

Band(s)				Resolution	Swath
AVNIR-1	BLUEGREEN	0.420 -	0.520 um	16.0 m	80 km
AVNIR-2	GREEN	0.520 -	0.600 um	16.0 m	80 km
AVNIR-3	RED	0.630 -	0.690 um	16.0 m	80 km
AVNIR-4	NIR	0.760 -	0.860 um	16.0 m	80 km
AVNIR-PAN	VISIBLE	0.400 -	0.700 um	8.0 m	80 km

<b>ALMAZ-1</b>		<b>ALMAZ-1 S/C SARSAT</b>			
Agency: RSA	Country: RUSSIA	loc: 03/31/91		Eom: / /	
Orbit: POLAR	Apogee 300 km	Perigee 360km	Incl.: 72.7°	Repeat: n/a	

**MAZ-1** **ALMAZ-1, Synthetic Aperture Radar** **SAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
S-SAR	S-BAND	3.125 -	GHz	10.0 m	40 km

<b>ALMAZ-1B</b>		<b>ALMAZ-1B, Earth Remote Sensing Satellite</b>			
Agency: RSA	Country: RUSSIA	loc: 12/31/96		Eom: / /	
Orbit: POLAR	Apogee 400 km	Perigee 400km	Incl.: 73.0°	Repeat: Variable	

**BALKAN-2** **Balkan-2 Lidar** **LIDAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
BAL-1	GREEN	0.532 -	um ND YAG	10.0 m	140 km

**OSSI** **Optronic Sensor for Stereo Imagery** **MSI**  
 Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)				Resolution	Swath
OSSI-1	GREEN	0.500 -	0.600 um	4.0 m	80 km
OSSI-2	RED	0.600 -	0.700 um	4.0 m	80 km
OSSI-2	NIR	0.700 -	0.800 um	4.0 m	80 km
OSSI-PAN	VNIR	0.580 -	0.800 um	2.5 m	80 km

**SAR-10** **ALMAZ-1B, Synthetic Aperture S-Band Radar** **SAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
SAR-10	S-BAND	3.130 -	GHz VV,HH,	5.0 m	55 km
SAR-10	S-BAND	3.130 -	GHz VV,HH,	15.0 m	70 km
SAR-10	S-BAND	3.130 -	GHz VV,HH,	15.0 m	170 km

**SAR-3** **ALMAZ-1B, Synthetic Aperture X-Band Radar** **SAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
SAR-3	X-BAND	8.600 -	GHz VV	5.0 m	35 km

**SAR-70** **ALMAZ-1B, Synthetic Aperture P-Band Radar** **SAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)				Resolution	Swath
SAR-70	P-BAND	43.00 -	MHz VV,HH,	22.0 m	170 km

<b>CBERS</b>		<b>China-Brazil Earth Resources Satellite</b>			
Agency: INPE CSA	Country: CHINA BRAZIL	loc: 12/31/96		Eom: / /	
Orbit: SUN SYNCHRONOUS	Apogee 778 km	Perigee 778km	Incl.: 98.5°	Repeat: 26 Days	

**Appendix C. All Imaging Satellites with Resolution Better than 30 Meters**

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<b>CCD</b>		<b>Charge-Coupled Device Camera</b>			<b>MSI</b>	
		Stereo Capability: Cross Track			Off Axis Repeat: 3 Days	
Band(s)					Resolution	Swath
CCD-1	VISIBLE	0.510 -	0.730 um		19.5 m	120 km
CCD-2	BLUEGREEN	0.450 -	0.520 um		19.5 m	120 km
CCD-3	GREEN	0.520 -	0.590 um		19.5 m	120 km
CCD-4	RED	0.630 -	0.690 um		19.5 m	120 km
CCD-5	NIR	0.770 -	0.890 um		19.5 m	120 km

<b>COSMOS 1870</b>		<b>COSMOS 1870, ALMAZ Prototype, USSR</b>				
Agency: RSA	Country: RUSSIA	loc: 07/25/87			Eom: 07/30/89	
Orbit: CIRCULAR	Apogee	275 km	Perigee	275 km	Incl.: 73.0°	Repeat: n/a

<b>S-Band SAR</b>		<b>COSMOS 1870, Synthetic Aperture Radar</b>			<b>SAR</b>	
		Stereo Capability:			Off Axis Repeat:	
Band(s)					Resolution	Swath
SAR-1870	S-BAND	3.125 -	GHz VV		25.0 m	20 km

<b>CRESS</b>		<b>Civilian Remote Sensing Satellite</b>				
Agency: LOCKHEED	Country: USA	loc: //			Eom: //	
Orbit: SUN SYNCHRONOUS	Apogee	0 km	Perigee	0 km	Incl.: 98.0°	Repeat: 247

<b>CRSS-1</b>		<b>CRSS Stereo Sensor</b>			<b>E-O</b>	
		Stereo Capability: Fwd/Aft			Off Axis Repeat:	
Band(s)					Resolution	Swath
CRSS-1	VISIBLE	0.450 -	0.800 um Stereo		1.0 m	0 km

<b>EOS AM-1</b>		<b>Earth Observation System, Ante Meridian Mission</b>				
Agency: NASA	Country: USA	loc: 01/01/98			Eom: //	
Orbit: SUN SYNCHRONOUS	Apogee	705 km	Perigee	705 km	Incl.: 99.0°	Repeat: 49 DAYS

<b>ASTER</b>		<b>Advanced Spaceborne Thermal Emission &amp; Radiation Radiometer</b>			<b>RAD</b>	
		Stereo Capability: Fwd/Aft			Off Axis Repeat: 5 Days	
Band(s)					Resolution	Swath
ASTER-SWIR	SWIR	1.600 -	2.500 um 6 Bands		30.0 m	0 km
ASTER-VNIR	VNIR	0.500 -	0.900 um 3 Bands		15.0 m	0 km

<b>ERS-1</b>		<b>European Remote Sensing Satellite 1</b>				
Agency: ESA	Country: EUROPEAN	loc: 07/17/91			Eom: //	
Orbit: CIRCULAR	Apogee	610 km	Perigee	610 km	Incl.: 57.0°	Repeat: 35 Days

<b>ERS-ALT</b>		<b>ERS Altimeter</b>			<b>ALT</b>	
		Stereo Capability:			Off Axis Repeat:	
Band(s)					Resolution	Swath
ERS-ALT	KU-BAND	13.700 -	GHz VV		20.0 m	80 km

<b>ERS-AMI</b>		<b>ERS Synthetic Aperture Radar</b>			<b>SAR</b>	
		Stereo Capability:			Off Axis Repeat:	
Band(s)					Resolution	Swath
ERS-AMI1	C-BAND	5.360 -	GHz VV Image		30.0 m	100 km
ERS-AMI2	C-BAND	5.360 -	GHz LV Wave		30.0 m	100 km

<b>ERS-2</b>		<b>European Remote Sensing Satellite 2</b>				
Agency: ESA	Country: EUROPEAN	loc: 12/31/94			Eom: //	
Orbit: SUN SYNCHRONOUS	Apogee	824 km	Perigee	824 km	Incl.: 0.0°	Repeat:

<b>ERS-ALT</b>		<b>ERS Altimeter</b>			<b>ALT</b>	
		Stereo Capability:			Off Axis Repeat:	
Band(s)					Resolution	Swath
ERS-ALT	KU-BAND	13.700 -	GHz VV		20.0 m	80 km

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**ERS-AMI** **ERS Synthetic Aperture Radar** SAR

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
ERS-AMI1 C-BAND 5.360 - GHz VV Image	30.0 m	100 km
ERS-AMI2 C-BAND 5.360 - GHz LV Wave	30.0 m	100 km

**Eyeglass** **Orbital Sciences & Eyeglass International**

Agency: CIV Country: USA loc: 01/01/97 Eom: / /

Orbit: SUN SYNCHRONOUS Apogee 710 km Perigee 710 km Incl.: 0.0° Repeat: 197 Days

**Eyeglass** **Eyeglass** E-O

Stereo Capability: Fwd/Aft Off Axis Repeat: 2 Days

Band(s)	Resolution	Swath
EYEGLASS-P VISIBLE 0.400 - 0.700um	1.0 m	15 km

**IRS-C/D** **Indian Resources Satellite C & D**

Agency: ISRO Country: INDIA loc: 01/30/94 Eom: / /

Orbit: SUN SYNCHRONOUS Apogee 900 km Perigee 900 km Incl.: 99.5° Repeat: 5-24 Days

**LISS-3** **Linear Self Scanning Sensor 3** MSI

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
LISS-3A GREEN 0.520 - 0.590um	20.0 m	140 km
LISS-3B RED 0.620 - 0.680um	20.0 m	140 km
LISS-3C NIR 0.770 - 0.860um	20.0 m	140 km
LISS-3PAN VISIBLE 0.500 - 0.750um	10.0 m	70 km

**JERS-1** **Japanese-Earth Resources Satellite**

Agency: NASDA Country: JAPAN loc: 02/11/92 Eom: / /

Orbit: SUN SYNCHRONOUS Apogee 568 km Perigee 568 km Incl.: 97.7° Repeat: 44 Days

**JERS-SAR** **JERS Synthetic Aperture Radar** SAR

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
L-SAR L-BAND 1.275 - GHz HH	18.0 m	75 km

**OPS** **JERS Optical Sensor** MSI

Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)	Resolution	Swath
SWIR-1 SWIR 1.600 - 1.700um	18.0 m	75 km
SWIR-2 SWIR 2.050 - 2.150um	18.0 m	75 km
SWIR-3 SWIR 2.150 - 2.250um	18.0 m	75 km
SWIR-4 SWIR 2.200 - 2.400um	18.0 m	75 km
VNIR 1 GREEN 0.520 - 0.600um	18.0 m	150 km
VNIR 2 RED 0.630 - 0.690um	18.0 m	150 km
VNIR 3 NIR 0.760 - 0.860um Nadir Stereo	18.0 m	150 km
VNIR 4 NIR 0.760 - 0.860um Forward Stereo	18.0 m	75 km

**LANDSAT4/5** **Land Satellite**

Agency: EOSAT Country: USA loc: 01/01/82 Eom: / /

Orbit: SUN SYNCHRONOUS Apogee 705 km Perigee 705 km Incl.: 98.2° Repeat: 16 Days

**TM** **Thematic Mapper** MSI

Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
TM-1 BLUEGREEN 0.450 - 0.520um	30.0 m	185 km
TM-2 GREEN 0.520 - 0.600um	30.0 m	185 km
TM-3 RED 0.630 - 0.690um	30.0 m	185 km
TM-4 NIR 0.760 - 0.900um	30.0 m	185 km
TM-5 SWIR 1.550 - 1.750um	30.0 m	185 km



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TM-7 SWIR 2.080 - 2.350um 30.0 m 185 km

<b>RADARSAT</b>		<b>RADARSAT</b>				
Agency: CSA	Country: CANADA	loc: 03/01/95		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee 800 km	Perigee 800km	Incl.: 98.6°	Repeat: 6 Days		

**C-Band SAR RADARSAT, Synthetic Aperture Radar SAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
EXTENDED-1 C-BAND 5.360 - GHz HH Extd1	19.0 m	75 km
EXTENDED-2 C-BAND 5.360 - GHz HH Extd2	28.0 m	170 km
FINE C-BAND 5.360 - GHz HH Fine	9.0 m	45 km
STANDARD C-BAND 5.360 - GHz HH STD	25.0 m	100 km
WIDE-1 C-BAND 5.360 - GHz HH Wide	28.0 m	165 km
WIDE-2 C-BAND 5.360 - GHz HH Wide	25.0 m	150 km

<b>RESURS-F</b>		<b>Russian Earth Resource Satellite -F Series</b>				
Agency: RSA	Country: RUSSIA	loc: 01/01/75		Eom: / /		
Orbit: POLAR	Apogee 240 km	Perigee 275km	Incl.: 82.3°	Repeat: n/a		

**KFA-1000 Camera System 1000mm CAM**  
 Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)	Resolution	Swath
KFA-1000-L VNIR 0.570 - 0.800um Left	5.0 m	120 km
KFA-1000-R VNIR 0.570 - 0.800um Right	5.0 m	120 km

**KFA-200 Camera System 200 mm CAM**  
 Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)	Resolution	Swath
KFA-200-1 GREEN 0.510 - 0.600um	25.0 m	180 km
KFA-200-2 NIR 0.700 - 0.840um	25.0 m	180 km
KFA-200-3 RED 0.600 - 0.700um	25.0 m	180 km

**MK-4 4-Channel Camera System 300mm CAM**  
 Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)	Resolution	Swath
MK-4-1 RED 0.640 - 0.690um	14.0 m	144 km
MK-4-2 NIR 0.810 - 0.860um	14.0 m	144 km
MK-4-3 GREEN 0.515 - 0.565um	14.0 m	144 km
MK-4-4 BLUEGREEN 0.460 - 0.510um	14.0 m	144 km
MK-4-5 RED 0.610 - 0.750um	14.0 m	144 km
MK-4-6 VISIBLE 0.435 - 0.680um	14.0 m	144 km

<b>SEASAT</b>		<b>Sea Satellite</b>				
Agency: NOAA	Country: USA	loc: 07/07/78		Eom: 10/09/78		
Orbit: ELLIPTICAL	Apogee 800 km	Perigee 776km	Incl.: 108.0°	Repeat: n/a		

**SEASAT-SAR Seasat Synthetic Aperture Radar SAR**  
 Stereo Capability: Off Axis Repeat:

Band(s)	Resolution	Swath
SEASAT-SAR L-BAND 1.350 - GHz HH	25.0 m	100 km

<b>SPOT 1 &amp; 2</b>		<b>Satellite Probatoire de l'Observation de la Terre</b>				
Agency: CNES	Country: FRANCE	loc: 01/01/86		Eom: / /		
Orbit: SUN SYNCHRONOUS	Apogee 832 km	Perigee 832km	Incl.: 98.7°	Repeat: 26 Days		

**HRV High Resolution Visible Sensor E-O MSI**  
 Stereo Capability: Cross Track Off Axis Repeat: 2 Days

Band(s)	Resolution	Swath
HRV PAN VISIBLE 0.510 - 0.730um Stereo	10.0 m	60 km
HRV-1 GREEN 0.500 - 0.590um	20.0 m	60 km

**Appendix C. All Imaging Satellites with Resolution Better than 30 Meters**

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HRV-2	RED	0.610 -	0.680um	20.0 m	60 km
HRV-3	NIR	0.790 -	0.890um	20.0 m	60 km

<b>SPOT 3</b>						<b>Satellite Probatoire de l'Observation de la Terre</b>					
Agency: CNES			Country: FRANCE			loc: 09/26/93			Eom: / /		
Orbit: SUN SYNCHRONOUS			Apogee 832 km			Perigee 832 km			Incl.: 98.7° Repeat: 26 Days		

**HRV High Resolution Visible Sensor E-O MSI**  
Stereo Capability: Cross Track Off Axis Repeat: 2 Days

Band(s)				Resolution	Swath
HRV PAN	VISIBLE	0.510 -	0.730um	10.0 m	60 km
HRV-1	GREEN	0.500 -	0.590um	20.0 m	60 km
HRV-2	RED	0.610 -	0.680um	20.0 m	60 km
HRV-3	NIR	0.790 -	0.890um	20.0 m	60 km

<b>SPOT 4</b>						<b>Satellite Probatoire de l'Observation de la Terre</b>					
Agency: CNES			Country: FRANCE			loc: 01/01/97			Eom: / /		
Orbit: SUN SYNCHRONOUS			Apogee 832 km			Perigee 832 km			Incl.: 98.7° Repeat: 26 Days		

**HRVIR High Resolution Visible and Infrared Sensor E-O MSI**  
Stereo Capability: Cross Track Off Axis Repeat: 2 Days

Band(s)				Resolution	Swath
HRVIR-1	BLUEGREEN	0.430 -	0.470um	20.0 m	85 km
HRVIR-2	GREEN	0.500 -	0.590um	20.0 m	85 km
HRVIR-3	RED	0.610 -	0.680um	10.0 m	85 km
HRVIR-4	NIR	0.780 -	0.890um	20.0 m	85 km
HRVIR-5	SWIR	1.580 -	1.750um	20.0 m	85 km
HRVIR-PAN	VISIBLE	0.510 -	0.730um	10.0 m	85 km

<b>WorldView</b>						<b>World View Imaging Corp</b>					
Agency: CIV			Country: USA			loc: 12/31/95			Eom: / /		
Orbit: SUN SYNCHRONOUS			Apogee 475 km			Perigee 475 km			Incl.: 98.0° Repeat: 120 Days		

**WV-MSS WorldView Multispectral Scanner MSI**  
Stereo Capability: Off Axis Repeat: 2 Days

Band(s)				Resolution	Swath
WV-1	GREEN	0.600 -	0.600um	15.0 m	900 km
WV-2	RED	0.610 -	0.680um	15.0 m	900 km
WV-3	NIR	0.790 -	0.890um	15.0 m	900 km

**WV-Stereo WorldView Stereo Sensor E-O**  
Stereo Capability: Fwd/Aft Off Axis Repeat:

Band(s)				Resolution	Swath
WV-PAN	VISIBLE	0.450 -	0.800um	3.0 m	36 km

**Appendix D: Database Listing of Users and Missions**

**Appendix D: Users and Missions**

<b>CENTRAL INTELLIGENCE AGENCY</b>		<b>CIA</b>	
<b>NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER</b>		<b>NPIC</b>	
National Photographic Interpretation Center	Bldg 213		Phone
<u>Mission(s)</u>	Washington	DC 20230	Fax
Monitor Foreign Nuclear Weapons Development & Proliferation			
Operational Intelligence			
Basic Intelligence			
Intelligence Estimates			
Remote Sensing Research and Development			
Arms Traffic Monitoring			
Scientific & Technical Intelligence			
Agricultural Crop Statistics			
Strategic Intelligence			
<b>COMMERCE DEPARTMENT</b>		<b>DOC</b>	
<b>NATIONAL OCEANIC &amp; ATMOSPHERIC ADMINISTRATION</b>		<b>NOAA</b>	
National Climatic Data Center	Federal Bldg.		Phone 704-259-0476
<u>Mission(s)</u>	Asheville	NC 28801	Fax
Global Climate Studies			
National Environmental Satellite Data & Information Service	World Weather Bldg, Rm 810		Phone 301-763-8127
<u>Mission(s)</u>	Camp Springs	MD 20233	Fax
Remote Sensing Product Development			
National Geophysical Data Center	325 Broadway		Phone 303-497-6215
<u>Mission(s)</u>	Boulder	CO 80303	Fax
Geophysical Research			
National Marine Fisheries Service	1335 East West Hwy		Phone 301-427-2239
<u>Mission(s)</u>	Silver Spring	MD 20910	Fax
Fishery Data Analysis			
National Ocean Service, Coast & Geodetic Survey	6001 Executive Blvd.		Phone 301-443-8204
<u>Mission(s)</u>	Rockville	MD 20852	Fax
Coastal Charting			
National Ocean Service, Earth Science & Geoscience Lab	1140 Rockville Pike		Phone 301-443-8858
<u>Mission(s)</u>	Rockville	MD 20852	Fax
Earth Science			
Global Change Research			
Geophysical Research			
National Oceanographic Data Center	1825 Connecticut Ave. NW		Phone 202-673-5594
<u>Mission(s)</u>	Washington	DC 20235	Fax
Oceanography			
National Weather Service	1325 East West Hwy		Phone 310-427-7689
<u>Mission(s)</u>	Rockville	MD 20910	Fax
Flood Prediction			
Weather Forecasting & Monitoring			
National Weather Service, Nat'l Opns Hydrologic Remote Sensing	6301-34th Ave. South		Phone 612-725-3039
<u>Mission(s)</u>	Minneapolis	MN 55450	Fax
Weather Forecasting & Monitoring			
<b>DEPARTMENT OF AGRICULTURE</b>		<b>USDA</b>	
<b>AGRICULTURAL RESEARCH SERVICE</b>		<b>ARS</b>	
Remote Sensing Lab	Bldg. 001 Rm. 334		Phone 301-504-6822
<u>Mission(s)</u>	Beltsville	MD 20705-2350	Fax
Remote Sensing Product Development			
<b>FOREST SERVICE</b>		<b>USFS</b>	
Fire & Atmospheric Science Research Staff	201 14th St. SW, 1st Floor Center		Phone 202-205-1561
<u>Mission(s)</u>	Washington	DC 20250	Fax
Wildfire Prevention			
Fire Research in Forest Environments			
Forest Environment Research Staff	201 14th St. SW, 1st Floor Center		Phone 202-205-1524
<u>Mission(s)</u>	Washington	DC 20250	Fax
Forest Environment Research			

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Forest Insects & Disease Research Staff <u>Mission(s)</u> Forest Insect & Disease Research	201 14th St. SW, 1st Floor SW Washington DC 20250	Phone 202-205-1532 Fax
Forest Inventory, Economic and Recreation Staff <u>Mission(s)</u> Conduct National Forest Inventory	201 14th St. SW, 1st Floor SW Washington DC 20250	Phone 202-205-1747 Fax
Headquarters <u>Mission(s)</u> Forest Protection	201 14th St. SW Washington DC 20250	Phone 202-205-1760 Fax
International Forestry Staff <u>Mission(s)</u> International Forest Monitoring	201 14th St. SW, 1st Floor SW Washington DC 20250	Phone 202-205-1092 Fax
<b>NATIONAL AGRICULTURAL STATISTICS SERVICE</b>		<b>NASS</b>
Headquarters <u>Mission(s)</u> Agricultural Crop Statistics	Independence Ave, Between 12 & 14th Washington DC 20250	Phone 202-720-2707 Fax
NASS Research & Applications Division, Remote Sensing Section <u>Mission(s)</u> Agricultural Crop Statistics	Independence Ave, Between 12 & 14th Washington DC 20250	Phone 202-720-6783 Fax
<b>SOIL CONSERVATION SERVICE</b>		<b>SCS</b>
Soil Conservation Service <u>Mission(s)</u> Soil Classification and Protection	South Agriculture Bldg. Rm. 5105A Washington DC 20250	Phone 202-720-4525 Fax
<b>DEPARTMENT OF DEFENSE</b>		<b>DOD</b>
<b>ADVANCED RESEARCH PROJECTS AGENCY</b>		<b>ARPA</b>
ARPA Nuclear Monitoring Research Office <u>Mission(s)</u> Monitor Foreign Nuclear Weapons Development & Proliferation	3701 N. Fairfax Dr. Arlington VA 22203-1714	Phone 703-696-2246 Fax
ARPA Software & Intelligent System Technology <u>Mission(s)</u> Automatic Target Recognition R&D	3701 N. Fairfax Dr. Arlington VA 22203	Phone 703-696-2222 Fax
Advanced System Technology Office <u>Mission(s)</u> Sensor Research & Development	3701 N. Fairfax Dr. Arlington VA 22203-1700	Phone 703-696-2307 Fax
Headquarters <u>Mission(s)</u> Defense Related R&D	3701 N. Fairfax Dr. Arlington VA 22203-1714	Phone 703-696-2400 Fax
<b>DEFENSE INTELLIGENCE AGENCY</b>		<b>DIA</b>
DA <u>Mission(s)</u> Operational Intelligence, Air, Land & Naval	The Pentagon Washington DC 20301	Phone Fax
DB <u>Mission(s)</u> Basic Intelligence	The Pentagon Washington DC 20301	Phone Fax
DC <u>Mission(s)</u> Scientific & Technical Intelligence	The Pentagon Washington DC 20301	Phone Fax
DIAC <u>Mission(s)</u> Intelligence Estimates	Bolling AFB Washington MD 20340-3205	Phone 202-373-2880 Fax
<b>DEFENSE LOGISTICS AGENCY</b>		<b>DLA</b>
Defense Technical Information Center, IR Information Center <u>Mission(s)</u> Infrared and Spectral Signature Database	ERIM PO Box 134001 Ann Arbor MI 48113-4001	Phone 313-994-1200 Fax
<b>DEFENSE MAPPING AGENCY</b>		<b>DMA</b>
Division of Cadastral Survey <u>Mission(s)</u> Coastal Charting Terrestrial Mapping	3200 South Second St. St. Louis MO 63118-3399	Phone Fax

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<b>DEFENSE NUCLEAR AGENCY</b>		<b>DNA</b>	
Headquarters	Kirtland AFB		Phone 505-844-5120 Fax
<u>Mission(s)</u>		NM 87115-5000	
Monitor Foreign Nuclear Weapons Development & Proliferation			
<b>JOINT CHIEFS OF STAFF</b>		<b>JCS</b>	
JCS J-2	The Pentagon Washington	DC 20302-7100	Phone Fax
<u>Mission(s)</u>			
Operational Intelligence, Joint			
<b>STRATEGIC DEFENSE INITIATIVE OFFICE</b>		<b>SDIO</b>	
Headquarters	The Pentagon, 1E1081 Washington	DC 20302-7100	Phone 703-695-7060 Fax
<u>Mission(s)</u>			
Space Defense Systems Development			
Sensor and Interceptor Technology Directorate	The Pentagon, 1E168 Washington	DC 20302-7100	Phone 703-693-1671 Fax
<u>Mission(s)</u>			
Sensor Research & Development			
<b>U.S. ATLANTIC COMMAND</b>		<b>LANTCO</b>	
JICLANT	Norfolk	VA	Phone Fax
<u>Mission(s)</u>			
Intelligence Support to Warfighters			
<b>U.S. CENTRAL COMMAND</b>		<b>CENTCO</b>	
CENTCOM J-2	Mac Dill AFB	FL	Phone Fax
<u>Mission(s)</u>			
Intelligence Support to Warfighters			
<b>U.S. EUROPEAN COMMAND</b>		<b>EUCOM</b>	
EUCOM J-2			Phone Fax
<u>Mission(s)</u>			
Intelligence Support to Warfighters			
<b>U.S. PACIFIC COMMAND</b>		<b>PACCOM</b>	
JICPAC	Pearl Harbor	HI	Phone Fax
<u>Mission(s)</u>			
Intelligence Support to Warfighters			
<b>U.S. SOUTHERN COMMAND</b>		<b>SOUTHCOM</b>	
USCS J-2	Panama City	PM	Phone Fax
<u>Mission(s)</u>			
Intelligence Support to Warfighters			
<b>U.S. STRATEGIC COMMAND</b>		<b>STRATCOM</b>	
SCJ-2	Offutt AFB Omaha	NE	Phone Fax
<u>Mission(s)</u>			
Intelligence Support to Warfighters			
<b>DEPARTMENT OF ENERGY</b>		<b>DOE</b>	
<b>DOE DEFENSE PROGRAM OFFICE</b>		<b>DPO</b>	
DPO	Mail Stop DP-1 Washington	DC 20545	Phone 202-586-2177 Fax
<u>Mission(s)</u>			
Environmental Impact Assessment & Monitoring			
<b>DOE FIELD OFFICES</b>		<b>ALB</b>	
Albuquerque	PO Box 5400 Albuquerque	NM 87185	Phone 505-845-6049 Fax
<u>Mission(s)</u>			
Environmental Impact Assessment & Monitoring			
Chicago	9800 S. Cass Ave. Argonne	IL 60439	Phone 708-252-2010 Fax
<u>Mission(s)</u>			
Environmental Impact Assessment & Monitoring			
Idaho	785 DOE Place Idaho Falls	ID 83401-1562	Phone 208-526-1322 Fax
<u>Mission(s)</u>			
Environmental Impact Assessment & Monitoring			
Nevada	PO Box 98518 Las Vegas	NV 89193-8518	Phone 702-295-1000 Fax
<u>Mission(s)</u>			
Environmental Impact Assessment & Monitoring Nuclear Test Assessment			

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Oak Ridge	PO Box 2001 Oak Ridge	TN 37831	Phone 615-576-4444 Fax
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring			
Richland	PO Box 1970, Mail Stop B3-01 Richlands	WA 99352	Phone 509-376-3997 Fax
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring			
San Fransisco	1333 Broadway Oakland	CA 94612	Phone 510-273-7111 Fax
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring			
Savannah River	PO Box A Aiken	SC 29802	Phone 803-725-2277 Fax
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring			
<b>DOE FOSSIL ENERGY PROGRAM OFFICE</b>			<b>FEP</b>
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring	1000 Independence Ave.SW Rm. 4G084 Washington	DC 20545	Phone 202-586-6660 Fax
<b>OFFICE OF HEALTH &amp; ENVIRONMENTAL RESEARCH</b>			<b>HER</b>
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring	Mail Stop ER-70, GTN Washington	DC 20545	Phone 301-353-3251 Fax
<b>OFFICE OF MILITARY APPLICATIONS</b>			<b>OMA</b>
<u>Mission(s)</u> Nuclear Weapons Production & Testing	A-367 GTN Washington	DC 20545	Phone 301-353-4221 Fax
<b>OFFICE OF NUCLEAR MATERIALS PRODUCTION</b>			<b>NMP</b>
<u>Mission(s)</u> Nuclear Material Production	DOE DP-GTN Washington	DC 20545	Phone 202-586-2185 Fax
<b>DEPARTMENT OF JUSTICE</b>			<b>DOJ</b>
<b>DRUG ENFORCEMENT AGENCY</b>			<b>DEA</b>
Office of Intelligence	DEA Office of Intelligence Washington	DC 20537	Phone 202-307-8050 Fax
<u>Mission(s)</u> Counter Drug Law Enforcement			
<b>FEDERAL BUREAU OF INVESTIGATION</b>			<b>FBI</b>
<u>Mission(s)</u> Law Enforcement	Ninth St. and Penna. Ave NW Washington	DC 20535	Phone 202-324-3000 Fax
<b>DEPARTMENT OF THE AIR FORCE</b>			<b>USAF</b>
<b>AIR FORCE INTELLIGENCE OFFICE</b>			<b>AFOI</b>
Headquarters	The Pentagon Washigton	DC 20302-7100	Phone Fax
<u>Mission(s)</u> Operational Intelligence, Air			
<b>AIR FORCE MATERIAL COMMAND</b>			<b>AFMC</b>
Electronic Systems Division	Hanscom AFB Bedford	MA 01730-5000	Phone 617-377-5111 Fax
<u>Mission(s)</u> Electronic Systems Development			
Headquarters	Andrews AFB Washington	DC 20334-5000	Phone 301-981-3241 Fax
<u>Mission(s)</u> Air Combat Systems Development			
Phillips Laboratory	Hanscom AFB Bedford	MA 01730-5000	Phone 617-377-3601 Fax
<u>Mission(s)</u> Sensor Research & Development			
ROME Laboratory	Griffiss AFB Rome	NY 13441	Phone 315-330-3053 Fax
<u>Mission(s)</u> Sensor Research & Development			
Wright Laboratory	Wright Patterson AFB Dayton	OH 45433-6523	Phone 513-255-5508 Fax
<u>Mission(s)</u> Scientific & Technical Intelligence, Air			

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<b>AIR FORCE SPACE COMMAND</b>		<b>AFSC</b>	
Air Force Weather Service			Phone
<u>Mission(s)</u> Weather Forecasting & Monitoring			Fax
<b>Program Offices</b>			Phone
<u>Mission(s)</u> Sensor Design and Applications Development		Los Angeles CA	Fax
<b>DEPARTMENT OF THE ARMY</b>		<b>USA</b>	
<b>ARMY CORPS OF ENGINEERS</b>		<b>COE</b>	
Topographic Engineering Center			Phone 703-355-2600
<u>Mission(s)</u> Terrestrial Mapping		Ft. Belvoir VA 22060-5546	Fax
Water Resources Support Center			Phone 202-355-3062
<u>Mission(s)</u> Hydrologic Monitoring and Research		Ft. Belvoir VA 22060-5586	Fax
Waterways Experiment Station		3209 Halls Ferry Rd.	Phone 601-636-3111
<u>Mission(s)</u> Waterway Monitoring and Maintenance Flood Prevention/Control		Vicksberg MS 39180-6199	Fax
<b>ARMY INTELLIGENCE OFFICE</b>		<b>AIO</b>	
Headquarters			Phone
<u>Mission(s)</u> Operational Intelligence, Land			Fax
<b>ARMY MATERIAL COMMAND</b>		<b>AMC</b>	
AMZPA		5001 Eisenhower Ave Alexandria VA 22333-0001	Phone 201-274-8010 Fax
<u>Mission(s)</u> Land Combat Systems Development			
USA Armament R&D Center Infrared Lab		SMCAR-FSP-E, B1530 Picatinny Arsenal NJ 07806-5000	Phone 201-724-3116 Fax
<u>Mission(s)</u> Infrared Sensor Development and Countermeasures			
<b>NATICK RESEARCH, DEVELOPMENT AND ENGINEERING</b>		<b>NRDEC</b>	
Individual Protection Directorate		Kansas St. Natick MA 01760-5000	Phone 508-651-4308 Fax
<u>Mission(s)</u> Camouflage Development			
<b>DEPARTMENT OF THE NAVY</b>		<b>USN</b>	
<b>CHIEF OF NAVAL OPERATIONS</b>		<b>CNO</b>	
Center for Naval Analysis		4401 Ford Ave. Alexandria VA 22302-0268	Phone 703-824-2000 Fax
<u>Mission(s)</u> Antisubmarine Warfare Studies			
David Taylor Research Center(s)		Bethesda MD 20084-5000	Phone 202-227-1515 Fax
<u>Mission(s)</u> Ship and Submarine Signature Reduction			
Fleet Weather Facility			Phone Fax
<u>Mission(s)</u> Weather Forecasting & Monitoring			
Naval Air Development Center		Street Rd Warmister PA 18974-5000	Phone 215-441-3067 Fax
<u>Mission(s)</u> Sensor Research & Development			
Naval Ocean Systems Center NOSC		271 Catalina Blvd. San Diego CA 92152-5000	Phone 619-553-3000 Fax
<u>Mission(s)</u> Collection Management Systems			
Naval Oceanographic Office NAVOCEANO		Bldg. 1002 Stennis Space Center MS 39522-5001	Phone 601-688-4203 Fax
<u>Mission(s)</u> Oceanography			
Naval Polar Operations Center			Phone Fax
<u>Mission(s)</u> Polar Research			
Naval Space Command		Dahlgren VA 22448-5170	Phone 703-663-7841 Fax
<u>Mission(s)</u>			



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Coastal Zone Studies Ocean Surveillance Systems			
Navy Space Systems Activity <u>Mission(s)</u> Sensor Design and Applications Development	PO Box 92960 Los Angeles	CA 90009	Phone 310-363-1824 Fax
Space & Naval Warfare System Command <u>Mission(s)</u> Sensor Design and Applications Development	Washington	DC 20363-5100	Phone 703-692-8768 Fax
<b>OFFICE OF NAVAL INTELLIGENCE</b>		<b>ONI</b>	
Headquarters <u>Mission(s)</u> Scientific & Technical Intelligence, Naval	Federal Center Suitland	MD	Phone Fax
Naval Maritime Intel Center <u>Mission(s)</u> Operational Intelligence, Naval	Federal Center Suitland	MD	Phone Fax
<b>OFFICE OF NAVAL RESEARCH</b>		<b>ONR</b>	
Director <u>Mission(s)</u> Ocean Engineering	800 N. Quincy St. Arlington	VA 22217-5000	Phone 703-696-5031 Fax
Institute for Naval Oceanography <u>Mission(s)</u> Oceanography	Stennis Space Center MS	39529-5005	Phone 601-688-5737 Fax
Naval Oceanographic & Atmospheric Research Lab <u>Mission(s)</u> Remote Sensing Applications Development	Bldg. 1005 Stennis Space Center MS	39529-5004	Phone 601-688-4010 Fax
Naval Research Laboratory <u>Mission(s)</u> Sensor Design and Applications Development	4555 Overlook Ave. SW, Code 1000 Washington	DC 20375	Phone 202-767-3403 Fax
Ocean Sciences Directorate <u>Mission(s)</u> Polar Research Coastal Zone Studies	800 N. Quincy St. Washington	DC 22217-5000	Phone 703-696-4398 Fax
<b>U.S. MARINE CORPS</b>		<b>USMC</b>	
CMCG-2 <u>Mission(s)</u> Operational Intelligence, Joint	The Pentagon	Navy Annex	Phone Fax
USMC Combat Development Center <u>Mission(s)</u> Intelligence Support to Warfighters	MCDEC Quantico	VA 22134-5001	Phone 703-640-2268 Fax
<b>DEPARTMENT OF TRANSPORTATION</b>		<b>DOT</b>	
<b>FEDERAL AVIATION ADMINISTRATION</b>		<b>FAA</b>	
FAA Technical Center <u>Mission(s)</u> Air Safety and Navigation Support	Atlantic City Intl Airport Atlantic City	NJ 08405	Phone 609-484-4000 Fax
<b>FEDERAL HIGHWAY ADMINISTRATION</b>		<b>FHA</b>	
<u>Mission(s)</u> Highway Construction, Safety and Maintenance			Phone Fax
<b>FEDERAL RAILROAD ADMINISTRATION</b>		<b>FRA</b>	
<u>Mission(s)</u> Railway Construction, Safety and Maintenance			Phone Fax
<b>MARITIME ADMIN.</b>		<b>MA</b>	
<u>Mission(s)</u> Ports and Harbors Monitoring Safety and Navigation			Phone Fax
<b>U.S. COAST GUARD</b>		<b>USCG</b>	
Headquarters <u>Mission(s)</u>	1082 Shennecossett Groton	CT 06340-6096	Phone 203-441-2600 Fax

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Maritime Law Enforcement  
 Coastal Pollution Monitoring  
 Ice Berg Monitoring  
 Maritime Search & Rescue

<b>URBAN MASS TRANSPORT ADMINISTRATION</b>	<b>UMTA</b>		
<u>Mission(s)</u> Mass Transport Systems			Phone Fax
<b>DEPT. OF THE INTERIOR</b>	<b>DOI</b>		
<b>BUREAU OF LAND MANAGEMENT</b>	<b>BLM</b>		
Cadastral Survey Division	222 W. 7th Ave. #13		Phone 907-271-5063
<u>Mission(s)</u> Land Use Inventory and Management	Anchorage	AK 99513	Fax
<b>BUREAU OF MINES</b>	<b>BM</b>		
<u>Mission(s)</u> Monitor Mines and Land Rehabilitation	2401 E. St. NW		Phone 202-634-1300
	Washington	DC 20241	Fax
<b>BUREAU OF RECLAMATION</b>	<b>BLR</b>		
<u>Mission(s)</u> Monitor Rehabilitation of Land Resources	1849 C. St. NW Rm. 7654		Phone 202-208-4157
	Washington	DC 20240	Fax
<b>FISH &amp; WILDLIFE SERVICE</b>	<b>FWS</b>		
<u>Mission(s)</u> Monitor and Manage Wildlife Habitats	1849 C St. NW		Phone 202-208-4717
	Washington	DC 20240	Fax
<b>MINERALS MANAGEMENT SERVICE</b>	<b>MMS</b>		
<u>Mission(s)</u> Monitor and Manage Offshore Minerals, Oil and Gas	1849 C. St. NW		Phone 202-208-3500
	Washington	DC 20240	Fax
<b>NATIONAL PARK SERVICE</b>	<b>NPS</b>		
Archeological Assistance Division	PO Box 37127		Phone 202-343-4101
<u>Mission(s)</u> Flood Prevention/Control Land Search & Rescue Archeology Natural Resource Preservation Wildfire Prevention	Washington	DC 20012-7127	Fax
<b>OFFICE OF SURFACE MINING, RECLAMATION &amp; ENFORCEMENT</b>	<b>SMRE</b>		
Technical Standards Branch	1951 Constitution Ave. NW		Phone 202-343-1507
<u>Mission(s)</u> Monitor Surface Mining Activity in U.S.	Washington	DC 20240	Fax
<b>U.S. GEOLOGIC SURVEY</b>	<b>USGS</b>		
National Mapping Division	516 Natl Cen. 12201 Sunrise Valley		Phone 703-648-5747
<u>Mission(s)</u> Terrestrial Mapping	Reston	VA 22092	Fax
<b>ENVIRONMENTAL PROTECTION AGENCY</b>	<b>EPA</b>		
<b>EARTH SCIENCES DIRECTORATE</b>	<b>ESD</b>		
Ecological Support Branch	College Station Rd.		Phone 404-546-3136
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring	Athens	GA 30613	Fax
<b>ENVIRONMENTAL SERVICES CENTER</b>	<b>ESD</b>		
Ecological Support Branch	College Station Rd.		Phone 404-546-3136
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring	Athens	GA 30613	Fax
<b>NATIONAL INVESTIGATIONS ENFORCEMENT CENTER</b>	<b>NIEC</b>		
<u>Mission(s)</u> Environmental Law Enforcement	PO Box 25227		Phone 303-236-5100
	Denver	CO 80225	Fax

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<b>FEDERAL EMERGENCY MANAGEMENT AGENCY</b>			<b>FEMA</b>
DAMAGE ASSESSMENTS			ODA
<u>Mission(s)</u> Damage Assessment and Remediation			Phone Fax
<b>HOUSING &amp; URBAN DEVELOPMENT</b>			<b>HUD</b>
COMMUNITY PLANNING AND DEVELOPMENT			CPD
<u>Mission(s)</u> Urban Planning and Development	451 7th St. SW Washington	DC 20410	Phone 202-708-2504 Fax
<b>NATIONAL AERONAUTICS &amp; SPACE ADMINISTRATION</b>			<b>NASA</b>
ALASKA SAR FACILITY			ASF
<u>Mission(s)</u> High Altitude Vegetation Studies Northern Geology Polar Research	600 Independence Ave. SW Washington	DC 20546	Phone 202-453-1409 Fax
<b>EARTH SCIENCES DIRECTORATE</b>			<b>ESD</b>
<u>Mission(s)</u> Remote Sensing Research and Development	Mail Code 900 Greenbelt	MD 20771	Phone 301-286-8834 Fax
<b>ENVIRONMENTAL SERVICES CENTER</b>			<b>ESD</b>
<u>Mission(s)</u> Remote Sensing Research and Development	Mail Code 900 Greenbelt	MD 20771	Phone 301-286-8834 Fax
<b>GODDARD SPACE FLIGHT CENTER</b>			<b>GSFC</b>
Terrestrial Physics Lab	Mail Code 920 Green Belt	MD 20771	Phone 301-286-6481 Fax
<u>Mission(s)</u> Global Circulation Oceanography Global Climate Studies Infrared Thermal Sensor Development & Applications Earth Science			
<b>HEADQUARTERS</b>			<b>NASA</b>
<u>Mission(s)</u> Space Research	NASA Headquarters Washington	DC 20546	Phone 202-453-2019 Fax
<b>JET PROPULSION LAB</b>			<b>JPL</b>
California Inst Of Technology	4800 Oak Grove Dr. Pasadena	CA 91109	Phone 818-354-4321 Fax
<u>Mission(s)</u> Remote Sensing Research and Development			
<b>JOHN C. STENNIS SPACE CENTER</b>			<b>JSSC</b>
<u>Mission(s)</u> Oceanography Global Change Research Earth Science	Bldg. 1100 Stennis Space Center MS	39529	Phone 601-688-2121 Fax
<b>NATIONAL SCIENCE FOUNDATION</b>			<b>NSF</b>
<b>DIRECTORATE OF ENGINEERING</b>			<b>NMMHMP</b>
Natural & Man Made Hazzard Mitigation Program	1800 G ST. NW Wachington	DC 20550	Phone 202-357-9780 Fax
<u>Mission(s)</u> Characterize Natural and Manmade Hazards			
Directorate for Geosciences			<b>DG</b>
Earth Sciences Division	1800 G St. NW Washington	DC 20550	Phone 202-357-7958 Fax
<u>Mission(s)</u> Dispersal of Pollutants			
Ocean Sciences Division	1800 G St. NW Washington	DC 20550	Phone 202-357-9639 Fax
<u>Mission(s)</u>			

**Appendix D: Users and Missions**

Oceanography

<b>NON-GOVERNMENT ORGANIZATION</b>		<b>NGO</b>	
ENVIRONMENTAL DEFENSE FUND		EDF	
<u>Mission(s)</u> Global Change Research Environmental Impact Assessment & Monitoring Polar Research			Phone Fax
<b>NUCLEAR REGULATORY COMMISSION</b>		<b>NRC</b>	
OFFICE OF NUCLEAR REGULATORY RESEARCH		ONRR	
<u>Mission(s)</u> Monitor Foreign Nuclear Weapons Development & Proliferation		5650 Nicholson Ln. Rockville MD 20555	Phone 301-492-0240 Fax
<b>STATE DEPARTMENT</b>		<b>STATE</b>	
<b>BUREAU OF INTELLIGENCE &amp; RESEARCH</b>		<b>BIR</b>	
INR	<u>Mission(s)</u> Intelligence Estimates	2201 C ST. NW Washington DC 20520	Phone 202-467-2222 Fax
<b>TENNESEE VALLEY AUTHORITY</b>		<b>TVA</b>	
<b>RIVER BASINS OPERATIONS, SYSTEMS ENGINEERING</b>		<b>MSD</b>	
Maps & Surveys Dept	<u>Mission(s)</u> Terrestrial Mapping	1101 Market St., HB-2A Chattanooga TN 37402-2801	Phone 615-751-5425 Fax
<b>U.S. ARMS CONTROL AGENCY</b>		<b>USACA</b>	
<b>ENVIRONMENTAL ASSESSMENTS</b>			
<u>Mission(s)</u> Arms Treaty Monitoring		320 21st St. NW Washington DC 20451	Phone 202-647-9610 Fax
<b>RESEARCH AND ANALYSIS</b>		<b>RA</b>	
<u>Mission(s)</u> Arms Treaty Monitoring Arms Traffic Monitoring Monitor Foreign Nuclear Weapons Development & Proliferation			Phone Fax
<b>UNITED NATIONS</b>		<b>UN</b>	
<b>ENVIRONMENTAL ASSESSMENTS</b>			
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring			Phone Fax
<b>FOOD AND AGRICULTURE ORGANIZATION</b>		<b>FAO</b>	
<u>Mission(s)</u> Agricultural Crop Statistics Fishery Data Analysis			Phone Fax
<b>WORLD BANK</b>		<b>UN</b>	
<b>ENVIRONMENTAL ASSESSMENTS</b>			
<u>Mission(s)</u> Environmental Impact Assessment & Monitoring			Phone Fax
<b>FOOD AND AGRICULTURE ORGANIZATION</b>		<b>FAO</b>	
<u>Mission(s)</u> Fishery Data Analysis Agricultural Crop Statistics			Phone Fax

## Appendix E: Glossary of Terms

Some of the terms used in Table 1 require definitions:

- **GSD, Ground Sample Distance;** The diameter of the sensor's resolution cell on the ground assuming some nominal operational altitude.  $GSD = H \times b$  where  $H$  is the altitude and  $b$  is the instantaneous field of view of the sensor (IFOV) measure in radians. For photographic systems GRD (Ground Resolved Distance) is still used.  $GRD = \text{Image Scale Reciprocal} / \text{line per } 1000\text{mm/m}$
- **IPR, Impulse Response;** a measure of the spatial resolution of an imaging radar. The spatial width of a radar return for a point reflector measured in range or azimuth 3dB down from the peak.
- **NIIRS, National Imagery Interpretation Rating Scale,** developed within the U.S. imagery intelligence community. It rates imagery based on its utility to identify particular objects of intelligence interest.
- **Sidelobe Envelope,** a measure of sidelobes in radar imagery.
- **SNR, Signal to Noise Ratio,** the ratio signal to noise, usually expressed in dB.
- **Band of Operation,** the range of frequencies of electromagnetic energy to which a sensor responds.
- **Center Frequency,** in the case of a SAR, the middle frequency of the FM chirp. A primary factor in determining the radar's sensitivity to surface roughness, surface waves, vegetation and ground penetration, soil moisture, and ice classification.
- **Bandwidth,** in the case of a SAR, frequency range of the FM chirp. The primary determining factor in range resolution.
- **CR, Contrast Ratio,** the ratio of the brightest to the dimmest points in an image. May be affected by atmospheric condition such as haze, and by response time of detectors.
- **Gamma,** a photographic term describing the slope of the film response curve. It is analogous to "Responsivity" for electronic detectors.
- **NE $\Delta$ T, Noise Equivalent Temperature,** the temperature level that equals the noise in a thermal sensor system, a measure of the lowest temperature detectable by the system.
- **NE $\Delta$  $\rho$ , Noise Equivalent Change in Reflectivity,** the power level that equals the noise in the sensor system, a measure of the lowest power signal detectable by an electro-optical system.
- **NEP, Noise Equivalent Power,** the reflectivity percentage that produces a radiance level equal to the noise in the sensor system, a measure of the lowest power signal detectable by the sensor.