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Remote Sensing Satellite Systems and Capabilities in Mapping Environmental Resources

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Abstract. In the dynamic field of remote sensing, cartography and geographic information systems (geoinformatics), remote sensing is bulk data generating format. This research review tends to present satellite remote sensing environmental data capture capabilities with their mode of images data acquisition method. It involves the presentation of detailed historical background of the systems' emergence since 80s to the present-day design, modes of data capture, height of sensor, bands and bandwidth, resolutions (m), wavelengths, scene, etc., highlighted for non-professionals to understand. Now, earth resources data are available through land observation satellite, the use of remotely sensed data for environmental baseline studies, have made it possible in acquiring earth's data which are cost effective, timely and repetitive in a consistent manner especially with the high-resolution satellites data promoted with the use of geographic information systems (GIS,) for analysis presentation. This is an effective procedure in establishing trend, nature and in location of surface phenomena for acquisition of environmental remotely sensed that include land, soil, vegetation, water, housing, settlement, climate, security, etc. data and their attributes data derived. Also, limited subsurface data on hydrology, soil, oil and gas, etc. are derivable from space studies and assessment due to increased spatial resolutions in modern satellites. These include: Landsat TM (30m), Landsat ETM plus (15m) and SPOT-HRV (high resolution visible) and HRVIR (high resolution visible infrared) of 10m, Nigeria Sat-l, 2, X (like Landsat TM of (30m)), Ikonos image (3.2m) panchromatic i.e. black and white (0.8m), Quickbird (2.4m) panchromatic (0.6m), and Worldview 1 (the world highest resolution satellite) with 0.5m resolutions respectively, using various wave bands. Thus, increased environmental surveillance and data collection are derivable from the emergence of updated and improved modern satellites' technology for space studies and assessment due to the increased performance in high-spatial resolutions, cost effectiveness, timeliness and repetitiveness in a consistent manner.

Keywords: Remote sensing, Satellite systems, Capabilities, Mapping, Environment, Resources.

1. Introduction

Remotely sensed satellite data is used for more than ten decades in various environmental programs and research studies across the globe from high-resolution orbit satellites. Thus, terrain and other environmental features image (imagery mapped are analyzed with increased ground resolution using Nigeria Sat-l like Landsat TM (30m), Landsat ETM plus (15m) and SPOT-HRV (high resolution visible) and HRVIR (high resolution visible infrared) of 10m, Ikonos image (3.2m) panchromatic or black and white (0.8m), Quickbird (2.4m) panchromatic (0.6m), and Worldview 1 (world highest resolution satellite) (0.5m) resolutions at various wave bands. Satellite remote sensing methodology is overwhelming and all-embracing in images (imageries) and digital elevation models (DEM) and with basic and adequate rudimentary knowledge of aerial methodology and interpretation using basic interpretative elements cannot be done without for thorough understanding of the overall practical and adherence to the global best practices applications. The use of satellite remotely sensed data for baseline studies have made it possible in acquiring remotely sensed earth's image data that are cost effective, timely and repetitive acquisition which are in a consistent manner especially with the high-resolution images This is promoted with the use of geographic information systems (GIS,) for analysis of data and presentation of results and therefore an effective procedure in establishing trend, nature and in location of surface phenomena on acquired image data. Also, limited subsurface data on hydrology, soil, oil and gas, etc. are derivable for studies and assessment due to increased spatial resolutions in the modern satellites build.

1.1 Objectives of study

The aim of this study is to examine satellite systems and capabilities in mapping environment resources for the potential of using remotely sensed data for environmental studies in provision and the manipulations of data to make decision and modeling.

1.2 Research Methodology

The data collected for this study are from secondary sources textbooks, journals, internet, remote sensing bodies manual and periodicals, government publications, etc.

1.2.1 Study Area

The study is restricted to satellite systems and capabilities in mapping environment resourcesThe use of various satellite data for environment could image features repetitively for a defined cycle that could also monitor inaccessible areas.

2. Literature Review

The historical review on remote sensing satellite system is further highlighted together with their capabilities in generating data is present below:

2.1 Skylab

This is an American spacecraft that was launched in May 14th 1973 and 11/ 7/79, it came down the earth in pieces. It was designed with earth resources experiment package (EREP) which was initially unmanned. It was later occupied sequentially by three astronauts from a period of May 25th 1973 to Nov 6, 1973. At the end of the period of Skylab, i.e. after four-space missions of the spacecraft, it was deactivated. In 1979, Skylab was airborne the earth's atmosphere and disintegrated over Australia.The EREP sensor systems included two photographic and four electronic sensor packages- multi spectral photographic systems used six identical cameras with different, film filter combinations in viewing the ground area simultaneously over the (0.4-0.8 urn) band range.

Skylab 2 was launched in October 1985 and had a geocentric orbit at approximately 400 km gonsisting of 3 platform and a unique structure called igloo on which several equipments will be exposed to space environment. The ESA equipment pointing systems are included in the payload. The Spacelab 3, which was launched in April 1984, is designed requiring a low gravity and motion stable environment emphasising material processing.

2.2 Heat Capacity Mapping Mission

This is an American program launched on April 26th 1978 designed using thermal kinetic (ability of a substance to resist charge in temperature with veriation of incident energy for example over a daily circle). The mission was designed to acquire repetitive thermal data twice daily at times close to the expected daily surface temperature (minimum and maximum. The satellite position is nearly sun-synchronous circular orbit for maximum sun ascending (1.30 PM) and its minimum (4.30 am) of the diurnal cycle. This is one of NASA application explorer mission (NEM) and is smaller and less expensive compared with Landsat series. Also, it is less precise in orbit accuracy and stabilization of altitude.

It carries one sensor-heat capacity mapping radiometer (HCMR). HCMR has 2 channels with the first equivalent to mss bend 7 (0.8-1.1 um) and the second is a thermal infrared radiation (10.5-12.5 um) which is a measure of thermal radiation. It transmits analogue data to 6 NASA receiving stations when the satellite is within range. It has spatial resolution of 600 m at the nadir. The HCMM is oriented to broad applications especially in areas of geology, hydrology and agriculture. It was initially planned for duration of one year but later had life span of 2-1/2 years. It is credited in provision of 6000 data passes and 26,500 frames of imagery. The data has been used in distinguishing rock types even though with vegetation cover, discriminate geology units (of similar albedo) from determination. Also, identify water tables, estimate moisture content, map industrial thermal pollution and map aerial snow extent.

2.3 Seasat

The USA launched Seasat on June 26 1978 on the proposed series of oceanographic research satellites. It is a platform orbit of near polar orbit at 800 km for provision of alternating data (day and night) covering 95% of the earth's ocean every 36 hours. The five sensors aboard Seasat are: (1) A compressed pulse radar altimeter to provide precision altimeter for marine body and sea surface topographic studies. (2) A wavelength scatterometer that measure global wind speed and directions. (3) A two scanning radiometers operating in the visible 0.52-0.73 (um) and infrared (0.5 to 12.5 um) portion of the spectrum to monitor the ocean colour and temperature. (4) Radiometer with five bands imaging between 6.6 and 0.8 cm. (5) An H-band (25 cm) synthetic-aperture imaging radar (SAR) to provide a determination of wave pattern and sea ice in selected areas.

SAR provides the first synoptic high-resolution radar images of the earth's surface with high rate of data acquisition (110 megabits per second). The SAR data were not recorded on board the satellite, but were transmitted to the earth when it is within range of ground receiving station and recorded on ground in five receiving stations receptive of SAR data. During its 90 days of operation, the Seasat SAR acquired images covers about 100 miles. The SAR have objective of potential monitoring of global surface waves-field and polar-sea condition. The image of the oceans revealed a circle spectrum of oceanic and atmospheric phenomena, which include: internal waves, current boundaries, eddy, front's bathy metric features, rainfall and storms. Except SAR, the other sectors were designed for continuous operation. SAR operates only when it was over selected high-data rate ground stations with incidence angle ranging 7° in high-relief terrain to 2° in low-relief terrain to reduce shadowing which create problem in landform discrimination in high relief regions owing to fore shorting and layovers. In Seasat-1, a massive short circuit in the electrical system terminated subsequent acquisition of data on October 10, 1978.

2.4 Space Shuttle

A space shuttle vehicle was launched first on April 1981 by USA, which marked a new era of manned space flight that could be repeatedly used. It has seven experiments selected to demonstrate its potential for earth resource research with a eight-man crew (commander, pilot, a mission specialist (NASA astronauts) and four pay load specialist that conduct shuttle i£ an orbital laboratory to conduct highly specialized experiments in the weightless and vacuum space condition and to receive and strategically place earth-orbiting satellites.The shuttle flight system consists of the orbital, external tank with ascent propellant used by main engines of the orbits, and two solid rockets, each with a sea-level thrust of 11.8 million Newtons.

The seven experiments will be used for investigating, geology, atmospheric chemistry, meteorology, marine, biology and plant physiology. It is being managed by office of space and terrestrial applications (OSTA) and the data will be available to the public with 6-12 months after mission completion.

The sensors of the shuttle include: (1) The shuttle imagine radar (SIR-A), (2) The shuttle multispectral infrared radiometers (SMIR). These are involved in the measurement of air pollution from satellite (MAPS), (3) The night and day optical survey of lighting (NOSL), (4) The ocean colour experiment (OCE), (5) The feature identification and location experiment (file) and (6) The helianthus annuus flight experiments (Heflex) Bio engineering test (HBT).

2.5 European Space Agency (Esa) Satellites

This was designed by European space agency (ESA) for ocean observation ESA resources satellite (ERS-I) use spot vehicle launched by ARIANE and launched in the period 1986-87. The sensor payload includes five (5) sensors (1) A synthetic aperture radar (SAR) With son resolution with 100 km swath, (2) Oceanic colour monitor 60 cm with 10 spectral bands (0.4-11.5 um), (3) Imaging microwave radiometer (IMR) operating in 6 frequencies (4), Two frequency scatterometer for detection of wind direction and velocity and (5) Radar altimeters for six sea state determination.

An advanced ESA satellite (AERS) had been launched around 1989 geared principally for land observation using spot vehicle and its payload to include SAR from ERS 1 an optical imaging instrument which would have six spectral bands (0.5-3025 um) with IFOV of 30m. And panchromatic band with a 15m IFOV and a 175 km swath

2.6 Canadian Radarsat

It was launched in 1990 and consists of a three axis stabilized platform of sufficient power and weight capacity to carry a c-band and an L-band synthetic aperture radar (SAR). It is designed to provide information on ice and water ocean body and to provide remotely sensed applications in forestry, geology, hydrology and agriculture. The wavelengths are l-band (23.5 cm) or c-band (5.7 cm)

2.7 Other National Systems

2.7.1 Chinasat

The people's Republic of China has launched several satellites since the launch of Chinasat-1 in 19^{th} July 1975. No images from Chinasat 1 to Chinasat 10 (launched Dec. 1976) have been made available to international community.

Additional Chinasat were scheduled and launched e.g., Chinasat 10 carried a 2-channel meteorological radiometer and infrared bands. In Nov. 1980, china announced the development of 11-band multispectral scanner, linear array sensor and synthetic aperture radar.

2.7.2 India Bhaskara

The Indian space research organisation (ISRO) developed an earth observation satellite (BHASKARA) placed in orbit by a USSR (Russian federation) vehicle launched from a cosmodrome in USSR (Russian federation).
It was designed to conduct earth resources observations in forestry, hydrology and geology using a two-band television camera system. It also conducts surface ocean studies using a two-frequency microwave radiometer system. USSR (Russian federation) launched an identical satellite (BHASKARA-2) in December 1981. ISRO developed second generation India resources satellite with collaboratory services of NASA and Russian agency.
The Netherlands agency space program in co-operation with Indonesia developed a tropical earth resources satellite (TERS) that carried a Dutch built multispectral linear sensor into a low inclination orbit. The sensor design is adapted to weather condition and vegetation types in the tropical area.

2.7.3 Ocean Monitoring Satellites

Most of the space satellites currently in use are modelled after the wavelength band of earlier ones like Spacelab and space shuttle. These include:

The coastal zone color scanner (CZCS). This is to provide coverage of large areas in repetitive regular intervals and designed specifically for ocean monitoring. Two CZCS sensors are carried on Seasat satellite. CZCS was launched by U.S.A. in 1978 and operated in June 1986. The designing as a proof ot concept mission; will measure ocean colour and temperature in coastal zones having imagery of 1600 km swath with a resolution of 825 m. A single imagery (with images) represents 2 minutes of data. Collection provides imaging of a 160 km (across track) by 800 m (along track) area.

It uses six channels and four bands in the visible portion, with a near infrared band and a thermal infrared band (see fig).

Bands	Wavelength (m)
1	0.43-0.45 (blue)
2	0.51-0.53 (green)
3	0.54-0.56 (green)
4	0.66-0.68 (red)
5	0.70-0.80 (near IR)
6	10.5-12.5 (thermal IR)

Fig. Showing wavelength bands used in CZCS.

Data from CZCS are used to map suspended sediment and phytoplankton organisms in coastal regions. CZCS data studies provide.

GEOSTATIONARY SATELLITE STATUS (GOES): The geostationary operation environment satellites provide atmospheric monitory of parameters such as cloud cover humidity and temperature for weather prediction goes satellites are civilian designed programme by the United States. It is a good stationary satellite orbiting the earth at 36,000 km i.e. in the same rotating direction of the earth therefore assumed a geostationary stationary position relative to the earth. Two GOES satellites covers north America area at longitude 75° west and GOES-west at longitude 135° west with two others covering Europe and Japan GOES produces images in 2 high visible (0.55-0.75 urn) and in the thermal infrared bands (10,2-2.5) have resolutions 8 to 14 km during the day and night.

The satellite imaging of the earth as a circular orbit covers longitudemo°E and 100°W and latitude 70°N and 70°S produced at the rate of 2 per hour, one on each band. Although, smaller areas can be frequently imaged such as in monitoring development of sever storm. GOES has equipments for detecting infrared in 12 separate wavelength bands.
The equipment collects data in a selected area (at a time) without producing the image the computer-processed data generate vertical temperature and moisture profiles through the atmosphere and are used in for casting weather conditions.

Application of GOES is in weather prediction, detection and tracking of sever storm events. These are used by the US action weather services and data stations in other countries to provide data on wide range of weathering warnings to the public, aviation, marine interest etc.

The sensors of the shuttle include: (1) The shuttle imagine radar (SIR-A), (2) The shuttle multispectral infrared radiometers (SMIR). These are involved in the measurement of air pollution from satellite (MAPS), (3) The night and day optical survey of lighting (NOSL), (4) The ocean colour experiment (OCE), (5) The feature identification and location experiment (file) and (6) The helianthus annuus flight experiments (Heflex) Bio engineering test (HBT). Nigeria Sat-l, 2, X):

2.7.4 Nigeria Sat 1

In April 1999, the government of Nigeria established the national space research and development agency

(NASRDA), with six operational centres, and mandated it to consolidate all space science and technology related activities in order to make a greater impact on scientific development efforts in Nigeria. The initiative has crystallised in the building and launching of the first Nigeria's satellite, called Nigeria sat- 1 on 27th September, 2003 (fig 1 &2).

The product of advanced technology in micro-satellite having a manageable size (100KG) and low-cost(affordability). Nigeria sat 1 is a camera based system with sensors in 3 spectral bands of green (0.52-6um), red (0.63-069um) and near infrared (076-0-9um) and a strong potential for NDVI normalised differential vegetation index), this can be used for a variety of applications and inferences including family early warning and appropriate decision-making to enhance food security.Has a ground sampling distance(GSD) of spatial resolution of 32um, as a swath width of 600km with a maximum of 600x570km ground coverage on a single image, equivalent to nine (9) scenes of US LandSat-TM which has similar resolution (30m)and Constellation with 4 other satellites (Alsat-1, UKDMC, BILSATA and china sat belonging to Algeria, UK, turkey and china respectively) gives Nigeria-1 added advantage of global coverage and daily revisit with provision of real time data. Nigeria sat 1 and the other satellites are launched and spaced in orbit(fig :3) to achieve a disaster monitoring constellation (DMC) facilitating partner-nations value added business and high public profile in terms of international disaster support and worlds first coordinated EO satellite constellation.

According to Wasrda, Nigeria Sat 1 offers a great potential for environmental and disaster management and monitoring such as deforestation, desertification, flooding, oil spills and environmental degradation, etc. Images are readily available in various formats at affordable cost and can be purchased in local and foreign currencies.

2.7.5 Nigeria Sat-2 and Nigeria Sat-X

Nigeria successfully launched two earth observation satellites to boost Africa capabilities for natural resources managements, as well as aid disaster relief through the disaster monitoring constellation Two of Nigeria satellites Nigeria sat-2 and Nigeria sat-x were successfully launched by 8:12am, Nigeria Sat-2 and Nigeria Sat-x space crafted were lifted into orbit aboard a Russia rocket from a launch pad in the two of Yasny, southern in Russia. Jt is one of the most advanced earth observation micro satellites ever to be launched. It was designed and assembled at SSTL in Guildford, it provide the Nigeria national space research and development agency (NASRDA) and the disaster monitoring constellation Sat-2 is based on the latest SSTL300 platform and deliver multiple viewing modes to a maximum 2.5m parichromatil (black and white) ground sample distance (GSD) and 5.0m multi-special (colour) GSD across a 20km swath width.

A second 32m GSD, 300km swath multi-spectral imager will provide data continuity with Nigeria previous SSTL- built satellite (Nigeria SAT-1) launched in 2003 and 13 still operational it is a high resolution satellite with a designed average life span of 7 years and a total weight mass of approximately 300kg. The Nigeria sat -2 has the ability to image various modes and provoke high resolution data. Nigeria and the rest of Africa in spatial data infrastructures in the following key sectors of the economy. Agriculture and food security, urban and rural planning, education, infrastructural monitoring amongst others.

2.7.6 Landsat

The land observation satellite (LANDSAT) was originally called the earth resources technology satellite (ERTS). It has been a valuable and prolific source of remotely sensed earth resource data since the first landsat was launched in 1972. A lot of progress has been made in processing and information techniques (NASA, 1982) to which imaging data and non-imaging data collection system (DCS) are applied for their practical use. Two more satellites were launched in 1975 and 1978. A second operational generation earth sensing capability. Landsat was designed for the limitation of the multispectral scanner (MSS) instrument. This landsat 4 was launched in July 10, 1982 after a decade of development effort. This is an improved earth observation sensor system called the thematic mapper. It has been a valuable and prolific source of remotely sensed earth resource data since the first landsat satellite, was launched on July 23, 1972 with most recent Landsat 7(ETM+) on April 15, 1990 as shown in table 2a below.

Table 2a. Landsat

Imaging and non-maging data collection system (DCS) generated and applied for practical terrain applications are used in an open non-discriminatory access policy of United States. Two more satellites landsat 2 and 3 were launched in 1975 and 1978. In 1975, ERTS satellite was renamed Landsat The thematic mapper (TM) achieved many improvement capabilities which adds simultaneously to the effectiveness with which the landsat data can be used.

The 4TM bands have a 30m picture elements (pixel) size except for band 6 having 120m.

2.7.7 Multi-Spectral Scanner (MSS):

These are mounted on landsat 4 and 5 being one of the older generation sensors, routine data acquisition for MSS was terminated in 1992. The resolution was 82m with radiometric coverage in four spectral bands ranging from the visible green to the NIR wavelengths. The MSS sensor characteristics are shown below.

Table 1: Showing wavelength bands of MSS

	Band	Wavelength (mm)	Resolution (m)
Green	4	05.-0.6	82
Red	5	0.6-0.7	82
NIR	6	0.7-0.8	82
NIR		0.8-1.1	82

2.7.8 Thematic Mapper ™:

The TM is also carried on Landsat 4 and 5. The sensors also detect reflected radiation from the earth's surface in the visible and NIR wavelengths, but the TM sensor provides more radiometric information than the MSS sensor. The wavelength range for TM sensor is from the visible blue, through the mid-infrared, into the thermal infrared portion of the EM spectrum the TM sensor characteristics are given below:

Table 2: Showing wavelength bands of TM

	Band	Wavelength (mm)	Resolution (m)
Blue	1	0.45-0.52	30
Green	2	0.52-0.60	30
Red	3	0.63-0.69	30
Near IR	4	0.76-0.90	30
SVViR	5	1.55 – 1.75	30
Thermal IR	6	10.40 – 12.50	120
SWIR	7	2.08-2.35	30

The wavelength range for TM sensor is from the visible blue, through mid-infrared, to the thermal infrared portion of electromagnetic of the (EMS) spectrum. The observation bands are essentially the same as TM and a newly added panchromatic band 8 with a high resolution of 15m added. An instrument malfunction occurred on May 31, 2003 that the scenes acquired since July 14, 2003. Landsat 4 & 5 TM scene has an instantaneous field of view of 30m by 30 meters i.e. 900 square meters in band 1 through 5 (as in band 7) and band 6 of 120 meters by 120 meters (14, 400 m^2) on ground resolution.

2.7.9 Landsat 7 (ETM+)

The US congress in 1992 approved a low cost multi-purpose satellite that supplied data to users into the next century. The program is committed to provide digital data to the users community in greater quantities, more quickly and at lower cost than any previous time in the program's history. The earth-observing instrument enhanced thematic mapper plus (ETM+) replicates the capabilities of highly successful thermatic mapper instruments on landsat 4 and 5 with a panchromatic band of 15m-spartial resolutions and a thermal IR channel of 60m resolutions. The ETM+ also induces feature that makes it a more versatile instrument for global studies, land/use cover monitoring, assessment and large mapping area than the designed forebears. The primary new features present an advantage (table 4) of

* a panchromatic band with 15m spatial resolution.
* on board full aperture, 5% absolute radiometric calibration and
* a thermal IR channel with 60m spatial resolution

Table 3 Shows landsat ETM+ Infrared bands.

	Band	Wavelength (um)	Resolution
0Blue	1	0.45-0.52	30
Green	2	0.52-0.60	30
Red	3	0.63-0.66	30
Near IR	4	0.76-0.90	30
SW IR	5	1.56-1.75	30
Thermal IR	6	10.40-12.50	60m
SW IR	7	2.08-2.35	30

The ETM+ is similar to TM instruments on landsat 6 that failed. The instrument is supported by ground network that receive ETM+ data via X- band in the receiving stations of US Geological surveys, Eros data centre in Sioux, South Bakota and it is managed by NASA.

Free download of Landsat image

Landsat TM & ETM+ and 742 Compressed mosaics and SRTM Google Earth Free online 'natural colour' TM or higher resolution images, perspective views are gotten as follow;

USGS http://landsat.usgs.gov Landsat 7 ETM+ to purchase, browse and order http://edcsns17.cr.usgs.gov/EarthExplorer/ worldwide cover of Landsat TM/ETM+ scenes, EO-1 AlI data (table1-2 for costs) Instrument Costs (US$) Resolutio
Swath (km)

Landsat-7 ETM+ 475 (April 1999-May 2003) 275-300 (after May 2003) 15, 30m, 60 m* 180
Landsat-4 and –5 TM 425 (1982-2005) 30 180

ASTER 80 15, 30, 90m* 60, EO-1 ALI 250 10, 30 m* 37* depending on band.
Table 1-1 Costs < US$ 500 of satellite scenes. Web site Available data Global
Land Cover Facility (University of Maryland, USA)

http://glcf.umiacs.umd.edu/portal/geocover/
Landsat TM & ETM+ and 742 Compressed mosaics and SRTM,Google Earth Free online
'natural colour' TM or higher resolution images, perspective views
USGS http://landsat.usgs.gov Landsat 7 ETM+ to purchase, browse and order
http://edcsns17.cr.usgs.gov/EarthExplorer/
worldwide cover of
Landsat TM/ETM+ scenes,
EO-1 ALI data (table1-2 for costs) & Instrument Costs (US$) Resolution Swath (km)
Landsat-7 ETM+475 (April 1999-May 2003), 275-300 (after May 2003) & 15, 30m, 60 m* 180
Landsat-4 and –5 TM 425 (1982-2005) 30 180, ASTER 80 15, 30, 90m* 60 & EO-1 ALI 250 10, 30 m* 37
* depending on band. Table 1-1 for Costs < US$ 500 of satellite scenes.

SPOT

It was designed and operated by French space center nationale d, etudes spatial es (CNES). The program began in 1978. The Systeme Probatoire d' observation de la Terre (SPOT) (fig.2) was designed to be a long-term operational commercial system, and subsequent satellites in the series are already being manufactured. It is a French design sensor which carries 2 Identical HRV push broom scanners, two tapes and recorders, and telemetric equipment to transmit data to the earth. The SPOT-1 was launched in early 1986 and has developed into an international programme with available data outlet in more than 30 countries for multidisciplinary use. It is advantageous in that, it has no moving parts, greater geometric fidelity, long life expectancy and better geometric accuracy. In addition, it has a resolution of 32m.

Spot has a sun-synchronous orbit at an altitude of 832 km and a return period of 26 days. When spot sensors are vertically pointed, they jointly acquire image of 117-km wide swath with each recording 60-km swath. And since the sensors are pointable, it has the capacity of viewing a location move frequently level producing repetitive timely data. It can be directed 127° left or right of the ground track by means of plane mirror, steerable by ground command. Thus, it is possible to view angles to achieve stereoscopic coverage of spot stereo images. The recent automation generates elevation data directly from digital imagery. The 2 identified push broom scanners called high resolution visible (HRV)

3. Conclusion

The satellite program no doubt is committed to provide affordable and free images (since declassification) and digital data for researches and other user's community in greater quantities, more quickly and at lower cost than any previous time period in satellite program's history.

Therefore, relatee companies and the government are enjoined to use the methodology for corporate social responsibility to the track natural hazards and nefarious activities in their area. The satellite world is very dynamic as improved technology upgrade performance for higher image resolution capabilities to upgrade environmental features with upgraded existing devices or production of new outfits. Therefore, researchers are enjoined to consistently contact countries and regional remote sensing offices for new inventions and development of the satellite-based technology from time to time.

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