KOMPSAT-1 Satellite

KOMPSAT-1 is a high resolution optical mission of Korea launched in 1999. Through a 3rd party mission agreement ESA will make a sample dataset of European cities available from this satellite. The KOMPSAT program was initiated in 1995 as a major space investment in Korea. Its objective is the development of a national space segment in Earth observation along with an efficient infrastructure and ground segment to provide valuable services to remote sensing users in various fields of applications.
The ESA European cities data set is visible via the EOLI catalogue.
AO now open at EOPI
EOC is the primary payload for KOMPSAT-1. It has cartography mission to provide images for the production of scale maps, including digital elevation models, from a remote earth view in the KOMPSAT orbit. EOC collects panchromatic imagery with the ground sample distance (GSD) of 6.6 m and the swath width of 17 km at nadir through the visible spectral band of 510 nm ~ 730 nm. EOC scans the ground track of 800 km per orbit by push-broom and body pointing method.

ESA provide a sample dataset only for European cities. The data are available as TIF images and correspond to a level 1B processing, e.g. no orthorectification or radiometric calibration.
Category-1 access to data has been opened and more information can be obtained at EOPI

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Product Details - detailed descriptions of data
Operators: KARI (Korea Aerospace Research Institute)
Date of Launch:
20 December 1999
Status: operating nominally
Orbit Height: 685 km
Orbit Type: Sun-synchronous circular polar
Repeat Cycle: 28 days
Resolution: 6m EOC
Swath Width: 24 km EOC
Onboard Sensors provided under TPM:
+ EOC (Electro-Optical Camera)

KOMPSAT-1 (Korea Multi-Purpose Satellite-1) / Arirang-1	
Type(s)	Service>Satellite mission>Earth observation
Owner	KARI (Korea Aerospace Research Institute)
Organisation	KARI (Korea Aerospace Research Institute)
Abstract	The KOMPSAT program was initiated in 1995 as a major space investment in Korea. Its objective is the development of a national space segment in Earth observation along with an efficient infrastructure and ground segment to provide valuable services to remote sensing users in various fields of applications. The science objectives of KOMPSAT-1 are: - To provide high-resolution imagery of the Korean Peninsula using EOC (Electro Optical Camera) - To collect wide-swath multispectral imagery of the ocean and coastal zones to support biological oceanography - To provide information on the LEO particle environment and globally on the plasma distribution in the ion layer using SPS (Space Physics Sensor. KOMPSAT-1 (Arirang-1) is a minisatellite, funded by the government of Korea and developed by KARI (Korea Aerospace Research Institute) in Taejon, along with seven Korean companies/institutes as well as by TRW of Redondo Beach, CA. The main objective of KOMPSAT-1 is to obtain imagery of the Earth's surface.
Location	Korea, Republic
Cross Reference(s)	More on KOMPSAT-1
	KOMPSAT-1 on Earthnet Online website

Discipline(s)	General Earth observation
Point of Contact	
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URL	http://www.kari.re.kr/
Miscellaneous	This record was added by the eoPortal Helpdesk.
Other Information	
Spatial Coverage & Location(s)	90° -180° 180° -90°
Event date description	Launch Date 20 Dec 1999 -
Language(s) of Resource	English Korean

KOMPSAT-1 (Korea Multi-Purpose Satellite-1) / Arirang-1

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- To provide high-resolution imagery of the Korean Peninsula using EOC (Electro Optical Camera)

- To collect wide-swath multispectral imagery of the ocean and coastal zones to support biological oceanography

- To provide information on the LEO particle environment and globally on the plasma distribution in the ion layer using SPS (Space Physics Sensor.

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Artist's view of the KOMPSAT-1 spacecraft in orbit (image credit: KARI)

Spacecraft:

The KOMPSAT-1 spacecraft is based on a TRW-developed standardized bus (of TOMS-EP heritage, including a MIL-STD-1555B communications bus) that can be easily modified to support a variety of mission requirements. A core (or equipment) module houses the housekeeping functions - power, telemetry and data handling, attitude control

- needed on all space missions. A payload module hosts mission-unique equipment, KOMPSAT's imaging instruments and space physics experiments. A third module, housing a monopropellant hydrazine propulsion system, provides on-orbit thrust and station-keeping.

The spacecraft size of KOMPSAT-1 is 1.33 m in diameter and 2.33 m in length. The platform uses a three-axis stabilized bus with a reaction control subsystem module, providing a 2-sigma pointing accuracy of 0.01º (roll), 0.18º (pitch) and 0.50º (yaw), and a pointing knowledge of 0.08º (roll and pitch) and 0.10º (yaw). The S/C mass is 510 kg (including 73 kg hydrazine), power = 630 W (500 W EOL), the S/C design life is three years.

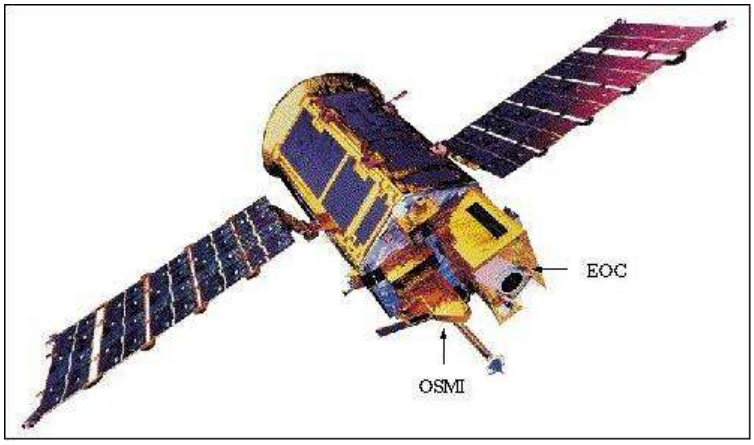
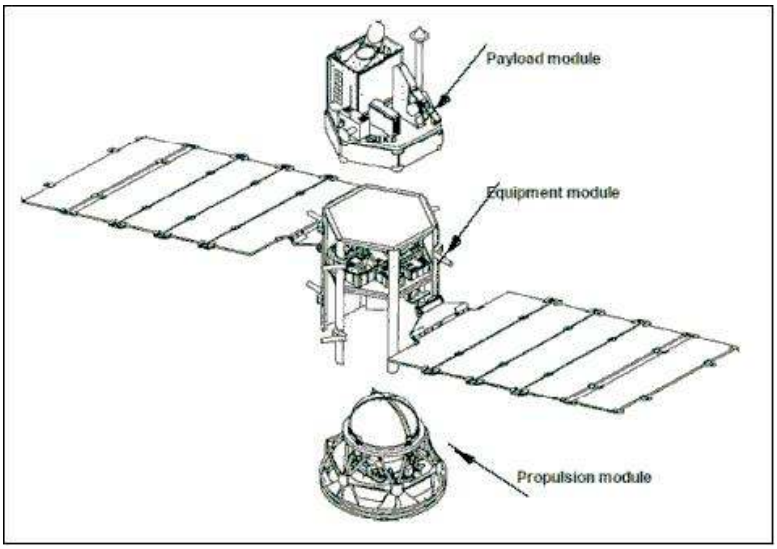
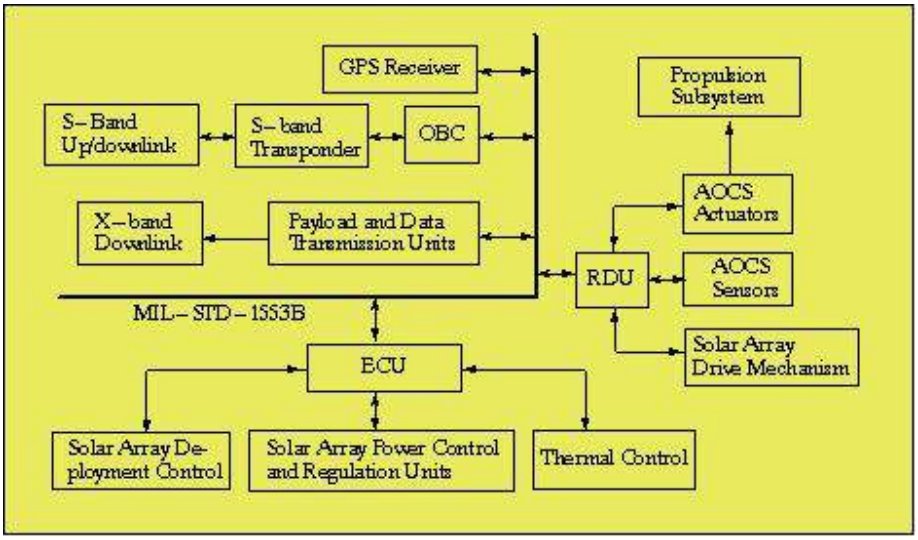


Illustration of the KOMPSAT-1 spacecraft (image credit: KARI)



Overview of KOMPSAT-1 design architecture (image credit: KARI)



Block diagram of the electrical subsystem of KOMPSAT-1

Launch: The KOMPSAT-1 satellite was launched on a Taurus booster (along with ACRIMSAT) from VAFB, CA on Dec. 20, 1999.

RF communication: S-band, downlink data rates are at 1.5 Mbit/s (playback) or 2.048 kbit/s (real-time), the uplink data rate is at 2 kbit/s. A second downlink in X-band provides data rates of 45 Mbit/s. The CCSDS protocol standards of CEOS are implemented for all communications. KOMPSAT-1 features a 1 Gbit onboard mass memory storage and a 8 Gbit solid-state recorder. As of 2004, KOMPSAT-1 data are also being acquired in Europe at DLR Neustrelitz (test acquisitions in preparation for KOMPSAT-2 data).

Orbit: Sun-synchronous circular polar orbit, altitude = 685 km, inclination = 98.13º, period = 98.46 min, local equatorial crossing on ascending node at 10:50 hours, 14 17/28 orbits per day, revisit time = 28 days.

KOMPSAT has three onboard processors: OBC (On-Board Computer) for command, telemetry and data handling management, RDU (Remote Drive Unit) for attitude and orbit control management including propulsion subsystem, and ECU (Electrical power system Control Unit) for electrical power and thermal control management. These three onboard processors are interfaced through MIL-STD-1553B data bus for basic communication and data handling function between them as shown in Figure 4. [5)]

The KGS (KOMPSAT Ground Segment) is located at Taejon, Korea, consisting of KMCS (KOMPSAT Mission Control Center) and KRPS (KOMPSAT Receiving and Processing System).

Mission status: KARI lost contact with its spacecraft on Dec. 30, 2007 -- ending the operational life of the KOMPSAT-1/Arirang-1 mission. Initial reviews pointed toward a possible machinery malfunction or a misalignment that may have affected power generation. In the first half of January 2008, KARI had made repeated but unsuccessful uplink efforts since contact was lost on December 30. *As of Jan. 31, 2008 the KOMPSAT-*

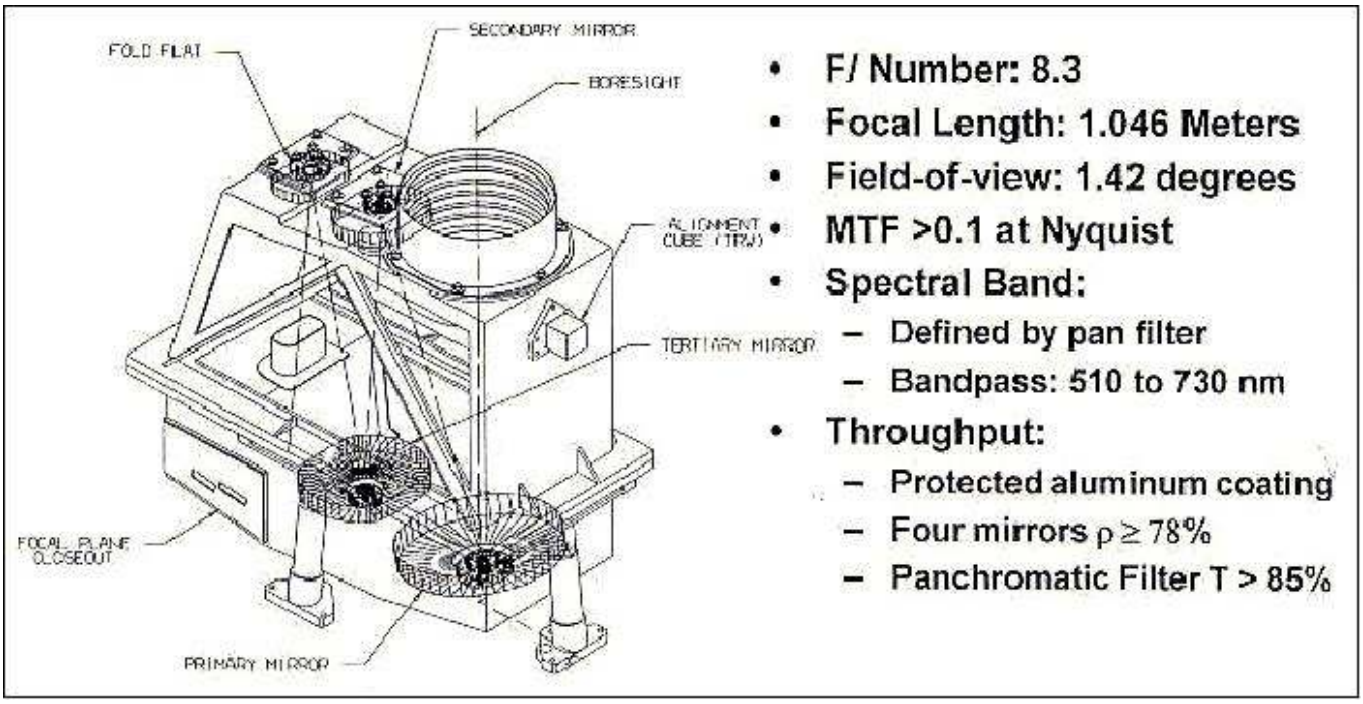
1/Arirang-1 mission was officially retired. The satellite is programmed to use its own power for an orbital descend and reentry. [6) 7)]

• The KOMPSAT-1 spacecraft and its optical payload provided an operational period of 8 years (5 years beyond the design life of 3 years). [8)]

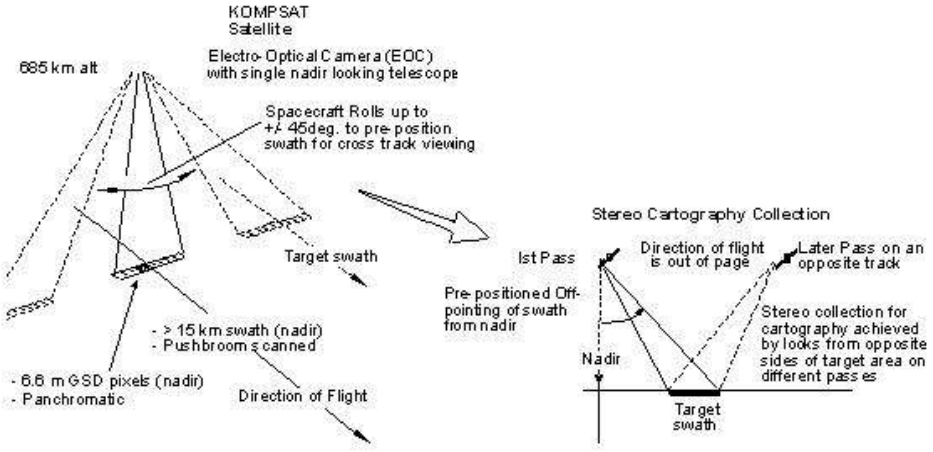
• The SPS (Space Physics Sensor) instrument experienced a malfunction in 2001 and is no longer operational.

Sensor complement (EOC, OSMI, SPS)

EOC (Electro-Optical Camera). The objective is to obtain cartographic imagery of Korea (may be extended to other regions of the globe) at 1/25.000 scale. EOC collects panchromatic imagery (spectral region of 510 - 730 nm) with a ground sample distance (GSD) at nadir of 6.6 m and a swath width of 17 km by pushbroom scanning. The S/C features a cross-track pointing capability (body pointing) of up to ±45º, thereby extending the field of regard for imagery collection. Some instrument parameters: MTF >10% at Nyquist frequency, SNR >50 over entire FOV, FPA has a CCD line array of 2592 pixels, data quantization of 8 bits, total instrument mass is 35 kg, power = 46 W, the source data rate is equal to or less than 25 Mbit/s. - Calibration: use of a built-in dark calibration function. In addition, ground reference targets of known brightness can be used for white calibration. [9)]



EOC opto-mechanical structure performance (image credit: KARI)



Overview of the EOC operational concept (image credit: KARI)

OSMI (Ocean Scanning Multispectral Imager). The wide-swath instrument is also referred to as **LRC** (Low Resolution Camera). The objective is global ocean color monitoring for the study of biological oceanography. OSMI is a whiskbroom-type imager generating imagery in up to six spectral bands (in the region of 400 - 900 nm) with a capability for bandwidth and band center selection on command. The center of each band can be varied within steps of 2.6 nm, and bandwidth ranges from 5.2 nm (min) to 166.4 nm (max) can be assigned. The ground resolution is 1 km in a swath of 800 km (0.85 km at nadir and about 1 km at the edge of the swath). The scanner assembly features a line array of 96 detectors (Si), positioned in the along-track direction, thus providing an instantaneous parallel ground coverage of 96 km in one cross-track scan with the whiskbroom configuration. This wide along-track coverage permits sufficient integration time for all cells in each scan sweep of about 15 seconds. Naturally there is some overlap for successive scans.

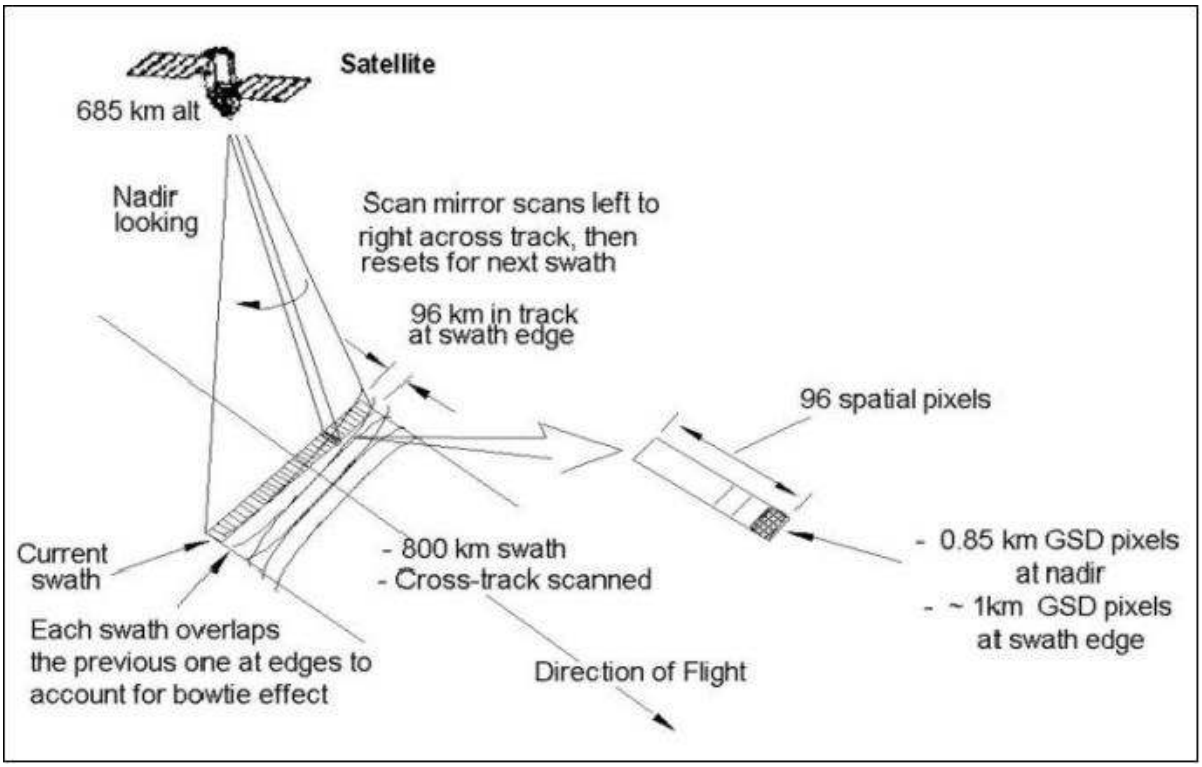
The ensuing collecting optics perform the spectral separation of the radiation received. The bands B0 through B4 provide ocean color data, the other bands provide information for atmospheric (aerosol) corrections. Some instrument parameters: MTF is about 20% at Nyquist frequency, SNR is between 350 and 450 over entire FOV, data quantization = 10 bits, instrument mass = 15 kg, power = 30 W, the source data rate is 600 kbit/s. The duty cycle for image collection is 20%. - Calibration: A solar calibration is performed with an onboard spectralon once per orbit (note: a spectralon is a kind of optical diffuser which can be used as a Lambertian source). Dark calibration is performed before and after each imaging period. [10) 11) 12) 13) 14)]

Spectral bands	B0	B1	B2	B3	B4	B5	BX	B6
Center wave length (nm)	412	443	490	510	555	670	765	865
Nominal bandwidth (nm)	20	20	20	20	20	20	40	40
Low band edge (nm)	401.64	432.88	479.76	500.59	544.86	659.43	745.36	846.92
High band edge (nm)	422.47	453.72	500.59	521.42	565.69	680.26	787.03	888.58

Spectral parameters of the OSMI instrument

Band selection parameters	- Maximum selectable band numbers : 6 band - Selectable band width : 400 ~ 900 nm - Band width step: 2.6 nm - Selectable minimum band width: 5.2 nm - Selectable maximum band width: 169nm - To be monitored by telemetry
Gain and offset control parameters	- Gain control parameter : 8 step - (e. g. 0.65 times ~ 3.1 times at 510 nm) - Offset control parameter for 4 channels: 256 step - (16 A/D counts per step) - Monitored by telemetry
On-orbit calibration by ground command	- Solar calibration on north pole per orbit - Normally dark calibration before and after image - Acquisition /solar calibration
LRC SOH data for mission operation	- Temperatures and powers status - Gain and offset - Selected bands - Mirror position
Image data storage capability	- 4 Gbit at BOL (Beginning Of Life) allocated - Stored for minimum 35 days mission

:Performance parameters of OSMI



Observation concept of OSMI (image credit: KARI)

SPS (Space Physics Sensor). The SPS package consists of two instruments: **HEPD** (High Energy Particle Detector) and **IMS** (Ionosphere Measurement Sensor). The objective for HEPD is to characterize the low-altitude high-energy particle environment and to study the effects of the radiation environment on microelectronics. The objective of IMS is to measure in-situ densities and temperature of electrons in the ionosphere.

• HEPD in turn consists of the following instruments: **PES** (Proton and Electron Spectrometer), **LET** (Linear Energy Transfer Spectrometer), **TDM** (Total Dose Monitor), and **SEM** (Single Event Monitor).

- PES identifies the particle types detected and measures their energy in seven channels. Objective: distribution of energetic electrons and proton in the radiation belts.

- LET measures particle populations, providing information of radiation effects on electronic components (comparison with TDM and SEM data).

- TDM measures with RADFET dosimeters the long-term ionizing dose of radiation (in SiO_2) accumulated at SPS. The threshold voltage provides information with respect to dose accumulation.

- The objective of SEM is to test exposed non-space qualified static RAM components in the radiation environment of KOMPSAT-1 for future space missions. The experiment uses four static RAM chips (4 Mbit), connected to appropriate circuitry, to measure SEU (Single Event Upset) characteristics.

• The IMS instrument contains an electron temperature sensor (ETS) and an electron density sensor (EDS), measuring temperature and density distributions of electrons (ionospheric plasma). EDS is a modification of a Langmuir Probe. The measurement range for ETS is 0 - 1 eV, for EDS the range is 10 - 10^6 e/cm^3.

Channel	Particle	Energy Range (MeV)
pE1	Proton	30-38
pE2	Proton	15-30
pE3	Proton	6.4-15
eE1	Electron	2.0 <
eE2	Electron	0.72-2.0
eE3	Electron	0.25-0.7
AA	Alpha particle	15-60

Table 3: Specification of PES (Proton and Electron Spectrometer) channels

Collection Details
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KARI KOMPSAT-1 EOC Inventory
(2000-01-01 00:00:00 \|)

Item Descriptor Identifier :	z39.50s://mwnd.infeo.org:10000/ARC_KARI.KOMPSAT11225
Collection Name :	KARI KOMPSAT-1 EOC Inventory
Temporal Coverage :	
Start Date :	2000-01-01 00:00:00
End Date :	
Corner Coordinates (Lat/Lon) :	+90°00'/-180°00' -90°00'/+180°00'
Abstract :	The Korea Aerospace Research Institute (KARI) acting as a Space Agency, a Research Institute and a data provider, has built and also operates the KOMPSAT (KOrea Multi Purpose SAtellite) series. KARI is also the main archive of KOMPSAT-1 data. KOMPSAT-1, the KOrea Multi Purpose SAtellite, flies in a low earth, sun-synchronous circular polar orbit at an altitude of 685 km. The inclination is 98.13 deg. and the orbital period is 98.46 min. KOMPSAT-1 passes at 10:50 AM (UTC) at an ascending node and has a revisit time of 28 days. KOMPSAT-1 is equipped with the high resolution Earth Observing Camera (EOC). The EOC collects panchromatic imagery (spectral region of 510 - 730 nm) with a ground sample distance (GSD) at nadir of 6.6 m and a swath width of 17 km by pushbroom scanning. The KOMPSAT-1 bus features a cross-track pointing capability (body pointing) of up to +/- 45 deg, thereby extending the field for imagery collection. The EOC has a CCD with 2592 pixels, uses a data quantization of 8 bits, and reveals a SNR of >50 over the entire FOV. The capacity of the on-board storage is sufficient for scenes up to approx. 800 km in length. The EOC is capable of producing images for cartographic purpose in a scale of 1:25.000. Data is collected world-wide, with major mission objective on the cartographic mapping of the Korean Peninsula. However, no data showing the Korean Peninsula will be made available to the public.
Originator :	Korea Aerospace Reserach Institute (KARI)
Platform :	
Mission and Satellite Identification :	KOMPSAT-1
Sensor/Instrument Identifier :	EOC
Campaign or Project Name :	KOMPSAT-1