

## RapidEye Mission

RapidEye is a small satellite commercial mission being developed by MacDonald Dettwiler & Associates (MDA) for the German firm RapidEye AG. This unique system, consisting of a constellation of five satellites, will enable global monitoring of the Earth's surface.

The RapidEye mission forms an integral part of a fast developing small satellite capability at MacDonald Dettwiler, combining the companies strong engineering background and sound management practices to provide low-cost, high reliability information systems. The system is the latest example of MacDonald Dettwiler's drive to develop a world-leading independent space mission prime capability and dominance in the development of missions for information delivery.

For the RapidEye program, MacDonald Dettwiler is providing a full information system to serve the growing agricultural insurance and products market. Starting with the customer's business plan, MacDonald Dettwiler's team has utilized the experience of our Information Systems and Information Products Groups to develop a mission solution that meets the technical and commercial needs of RapidEye AG.

### **MISSION OBJECTIVES:**

RapidEye is designed to provide insurance and food companies, farmers, government and other agencies and institutions throughout the world with valuable, up-to-date, customized information products and services of the highest quality.

The mission will serve key market segments including:

- **Agricultural Insurance:** RapidEye will offer regularly updated field maps to help insurers in the insurance contract assessment and will support the loss adjustment process by providing quick and reliable information about areas damaged by hail storms, flooding, drought, pests, etc.
- **Agricultural Producers:** The information generated by RapidEye will support the precision farming system substantially by regularly providing information about crop conditions and yield predictions. The information will help farmers to improve the efficiency of their fields and their crop management.
- **International Institutions:** RapidEye will provide comprehensive, up-to-date information to assess expected levels of crop harvests; monitor usage of subsidies for emergency relief in disaster situations.



## MISSION OVERVIEW:

The RapidEye Mission is scheduled for launch in 2007. The five satellites will be launched on one vehicle and placed in a common sun-synchronous orbit of 620 km, with the satellites equally spaced about 19 minutes apart in their orbit, ensuring frequent imaging of particular areas of interest.

The RapidEye system can image any area in the world at all latitudes between  $\pm 75$  degrees within one day and cover the entire agricultural areas of North America and Europe with an average of five days.

Each day, the RapidEye system can image more than 4 million square-kilometers of the Earth's surface the equivalent of monitoring the entire land mass of Canada in only two days! Each spacecraft is capable of sending 37,500,000,000 bits of compressed data, to the ground each time it passes directly over a ground receiving station. The ground processing system, also provided by MacDonald Dettwiler, can process 1,500,000 square-kilometers of ortho images from the raw data per day, and can be easily expanded up to 4 million square-kilometers per day.



*RapidEye constellation in one orbital plane*

## SPACECRAFT DESCRIPTION:

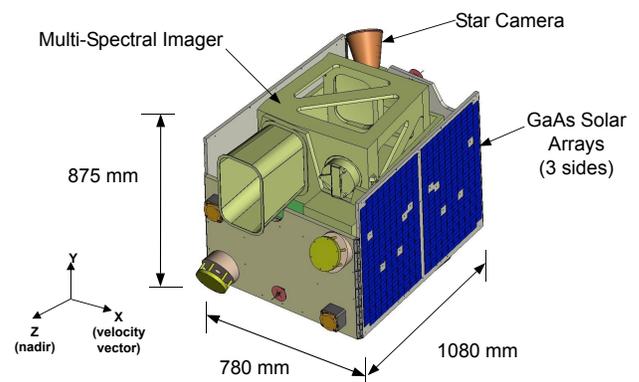
These compact satellites, each measuring less than 1 metre cube and weighing only 150 kg, provide advanced imaging performance. The use of flight proven systems and several layers of redundancy provide a high degree of reliability. The two primary elements of the spacecraft are the bus and payload.

### Bus:

The spacecraft bus is based on a flight proven design. The bus houses the computers, propulsion, communications and electrical power equipment. It also provides the electrical power.

Key subsystems include:

- The spacecraft's attitude control system has four reaction wheels for accurate pointing of the spacecraft at the Earth. A star camera provides spacecraft attitude information. A gas propulsion subsystem ensures the satellite can be maintained in its correct orbit
- An on-board GPS provides orbit knowledge and time synchronization with the payload
- The TT&C subsystem uses the S-Band to receive information and commands from ground stations and to send telemetry to the ground. An X-Band subsystem is used to down link image data
- The power subsystem includes three solar panels, NiCd battery packs, battery charge regulators, power distribution and switching electronics
- A launch vehicle interface
- Onboard computers to perform housekeeping functions



*RapidEye Spacecraft Configuration*

## Payload:

The RapidEye Payload consists of two separate subsystems, the Multi-Spectral Imager (MSI) and the Payload Electronics Unit (PEU). The PEU is located in the central area of the spacecraft with Bus subsystems while the MSI is mounted outside of the central Bus area, so that its baffle and aperture can face the Earth for imaging.

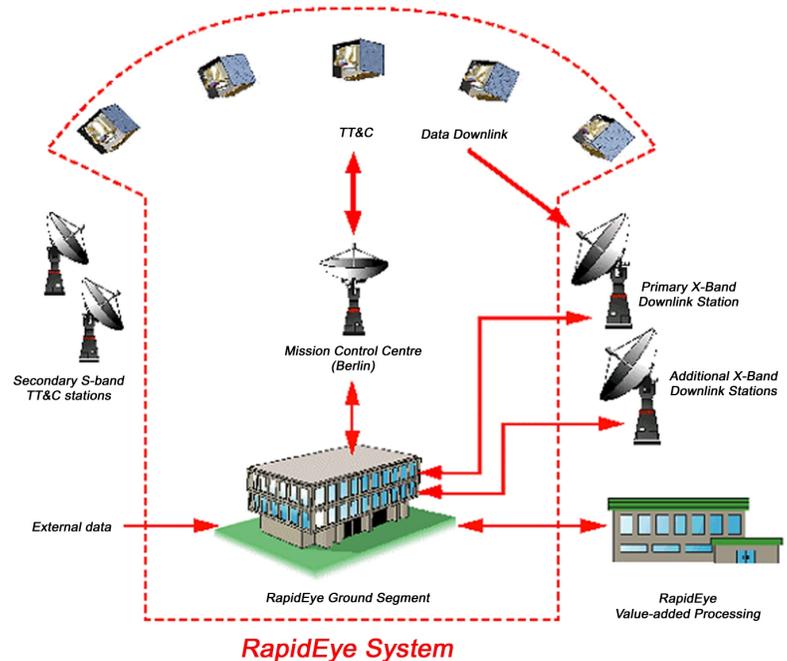
The heart of the RapidEye payload is a 5-band push-broom multi-spectral imager. The five spectral bands are used to distinguish features that are not visible to the human eye. The imager has a 145 mm aperture and images a 78 km wide moving swath of the Earth using a light sensitive CCD (Charge Coupled Device) detector that can detect light in the visible spectrum and beyond into the near infrared. Image data is compressed using a standard JPEG algorithm and stored in a mass memory unit before being transmitted to the ground via X-band. This precise imager design is tailored to provide spectral information of the quality needed to support RapidEye AG's agricultural applications.

The multi-spectral imager captures information in five spectral bands.

## GROUND SEGMENT:

Building on our 25-year expertise in delivering fully-operational ground stations around the world, MDA will develop the ground segment to be located at RapidEye's operational facility in Brandenburg, Germany. The ground segment features commercial off-the-shelf hardware and MDA proprietary software that has been selected for its performance, maintainability and expandability. The ground based equipment and facilities consist of:

- A dedicated Spacecraft Control Centre to control the spacecraft constellation
- A ground segment that provides the data processing, archiving facilities and customer interfaces
- Use of commercial data downlink sites
- An interface to RapidEye AG's product processing facility that uses the image data from the ground segment to generate the information products needed by customers.



## The RapidEye Team:

Prime Contractor : MacDonald Dettwiler  
Ground Segment : MacDonald Dettwiler  
Bus Platform : Surrey Satellite Technology Ltd (SSTL) - U.K.  
Payload : Jena-Optronik GmbH - Germany

Expected Launch Date	2007
Mission Life	7 Years
Orbit Altitude	Nominally 620 km
Orbit Inclination	Approximately 97.8 degrees, sun synchronous
Daily Orbits	Approximately 15 orbits per day per spacecraft
Equator Crossing Time	11:00 hours
Spacecraft Mass	150kg each
Bus Dimensions	875 mm x 780 mm x 1080 mm
Payload Type	Push-broom Optical Imager (no moving parts)
No. of Optical Bands	5 (440 -850 nm)
Swath Width	Approximately 78 km
Nadir Ground Sample Distance (Resolution)	6.5 m
Onboard Storage	1500 km of image data - all bands.
Image Data downlink	>60 Mbits per second.
Global Revisit Time	1 day
Average Coverage Repeat Period (Europe and North America)	<5 days
Ground Segment Storage Capacity 3-level hierarchical storage: <ul style="list-style-type: none"> <li>• On-line archive</li> <li>• Near-Line archive</li> <li>• Off-line vault</li> </ul>	150 Tbytes 150 Tbytes

*On a Mission*