UN-MANNED SATELLITES ON POSTAGE STAMPS 13:

RADARSAT, ENVISAT, SEAWIFS/SEASTAR, OKEAN/SICH, ALMAZ, AND ZY-1/CBERS

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This is the thirteenth in a series of articles about un-manned satellites on postage stamps, featuring several low-earth polar-orbiting environmental-observing satellites not covered previously in this series. These remaining satellites appear on at least one postal item each.

The first satellite covered in this article is the Canadian Space Agency's **Radarsat** (Radar Satellite), which was launched on 4 November 1995. The main instrument on Radarsat is an active microwave Synthetic Aperture Radar (SAR), which was the first operational SAR in orbit. The SAR provides global data on ice conditions, crops, forests, oceans, and geological formations. The whole of Canada can be covered every 72 hours, and the entire Arctic daily. One advantage of SAR is that microwave energy penetrates clouds, so that measurements can be made in the presence or absence of clouds. Radarsat data are processed and made available within 24 hours to high priority users such as ships in the high Arctic. Radarsat was launched by NASA in return for access to its data by researchers and the private sector in the U.S. A company known as Radarsat International was formed in 1989 to market the data internationally.

Features of Radarsat include two large rectangular solar panels and a 1.5 m wide by 15 m long SAR antenna. Images of Radarsat are featured on stamps from Canada and Mali, as well as a Canadian cancel, as indicated in the accompanying table.

The second satellite featured in this article is **Envisat** (Environmental Satellite) launched on 1 March 2002 and operated by the European Space Agency. Envisat is a follow-on to the two ERS satellites discussed in a previous article in this series. There are a large number of instruments on Envisat, including an advanced SAR, a radar altimeter, visible and infrared imaging and passive sounding instruments, a microwave radiometer, and an ozone-monitoring instrument.

Envisat is a large satellite, 10 m long by 3 m wide, with a single 5 m by 14 m solar array. One particularly notable feature of the spacecraft is the long and narrow SAR antenna. Envisat is featured on stamps from Mali and Somalia. An early-concept version of Envisat appears on both a stamp and a souvenir sheet from Comoro Islands. Those two items show a "Columbus" platform, an early design with many features that were incorporated into the current Envisat design. The Columbus platform was never built.

The third satellite covered in this article is often called **SeaWiFS** (Sea-viewing Wide Field-of-view Sensor) because that is the name of the primary instrument on board the satellite formally known as **SeaStar** (also called **OrbView-2**) launched on 1 August 1997. The global environmental data from SeaWiFS is the

first that the U.S. government has purchased from a privately-owned and operated remote-sensing satellite. SeaWiFS was designed to measure ocean surface-level productivity of phytoplankton and chlorophyll for ocean dynamics and marine life research. It also measures water optical properties and suspended sediments. The SeaWiFS instrument is a next-generation design of the Coastal Zone Color Scanner launched on Nimbus-7 in 1978. That instrument operated for nearly nine years!

SeaStar has solar panels in an X-pattern that are attached to a relatively-small body pointing toward the earth. A pivoting telescope, rather than a rotating mirror, scans the scenes of interest. SeaWiFS/SeaStar is featured on only one known stamp, issued by Chile in 2000. Other satellites in the OrbView series will hopefully be covered in future article.

Next to be discussed in this article are the Russian-designed environmental-observing satellites called **Okean** or "ocean". Several of these all-weather ice and oceanographic satellites have been launched since the first pre-Okean (Kosmos-1076) in 1979. Okean variations include the updated Ukrainian version of Okean named **Sich** or "sickle" launched in 1995. Instrumentation provides data in the visible, infrared, and microwave bands, as well as active microwave side-looking radar.

Okeans have solar panels attached to a somewhat cylindrical body that are a bit reminiscent of those on U.S. Nimbus satellites. Below the body are the instruments and antennas. Okean and Sich-1 appear on only a very small number of Russian and Ukrainian postal items as given in the table.

Another Russian remote sensing satellite is **Almaz** or "diamond". After a pre-Almaz (Kosmos-1870) was launched in 1987, the operational Almaz-1 went into orbit in 1991. A variety of instruments were aboard Almaz, including a SAR. Almaz is a very large spacecraft about 4 m in diameter and 15 m long with two large solar panels as well as antennas attached to the body. Almaz appears on a stamp issued by Malagasy in 1999 available both as part of a miniature sheet of six and a souvenir sheet of one.

The final environmental-observing satellite covered in this article was a joint venture between the People's Republic of China and Brazil. The Chinese name is **ZY-1** (Zi Yuan [or] Zhong Guo Zi Yuan), and the English name is **CBERS** (China-Brazil Earth Resources Satellite). CBERS was launched in 1999 and carried SPOT-like instrumentation. Visible and thermal/infrared imagery will be marketed in competition with both SPOT and Landsat (both of these satellites were covered in previous articles in this series).

The CBERS spacecraft has a box-like body about 2 m on a side. There is a 2.6 m by 6.3 m solar panel attached to one side of the body. CBERS is known to appear on only one known postal item: a stamped envelope issued in 2001 by China.

A table and images of postal items showing these satellites are presented both here and on the Website developed and maintained by the authors: **http://www.cira.colostate.edu/ramm/hillger/satellites.htm**. E-mail correspondence with the authors is welcome. Don Hillger can be reached at **hillger@cira.colostate.edu** and Garry Toth at **garry.toth@ec.gc.ca**.

Checklist of Postal Items Showing Radarsat, Envisat, SeaWiFS/SeaStar, Okean/Sich, Almaz, and ZY-1/CBERS

Country	Catalog #*	Type of Item**	Year	Notes on Content
Radarsat (Canada)				
Canada	None	Cancel	1996	Radarsat
Canada	1831c	One of MS4 (1831a-d)	2000	Radarsat
Mali	847d	One of MS4 (847a-d)	1996	Radarsat
Envisat (ESA)				
Comoro Islands	768		1991	Early-concept Envisat
Comoro Islands	BL350	SS1 (768)	1991	Early-concept Envisat
Mali	847c	One of MS4 (847a-d)	1996	Envisat
Somalia	Unknown	In margin of imperforate SS1	2002	Envisat
SeaWiFS[1]/SeaStar (USA)				
Chile	1339		2000	SeaWiFS/SeaStar
Okean/Sich (Russia/Ukraine)				
Russia	5496	One of pair 5497a (5496-5497)	1986	Prototype Okean
Russia	5497b	MS8 (4x(5496-5497))	1986	Prototype Okean
Russia	None	Postal card	1987	Okean
Ukraine	240		1996	Sich-1 (Okean-O)
Almaz (Russia)				
Malagasy	1415c	One of MS9 (1415a-i)	1999	Almaz
Malagasy	1415cSS1	SS1 (1415c)	1999	Almaz
ZY-1/CBERS (PRC/Brazil)				
China (People's Republic)	None	Stamped envelope	2001	ZY-1

Ukraine 240

* *Scott* catalog number, unless indicated with Mi or BL for *Michel*.

** SS# = souvenir sheet, MS# = miniature sheet, where # = number of stamps in sheet, and the numbers in parentheses are the catalog numbers of the stamps in the sheet.

[1] SeaWiFS is the main instrument on the SeaStar/OrbView-2 satellite. V

Left: Mali 847c
Middle: Comoro 768
Right: Somalia SS