Spotlight on VUSAT OSCAR 52 (VO-52)

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In previous columns, I've been assisting those interested in receiving (and if properly licensed) actually working through our growing fleet of Amateur Radio satellites to do so with just modest radio equipment. In this edition, I'll turn the spotlight on one of our newest (linear) analog satellites.

VO-52 (also known as VUSAT and/or HAMSAT INDIA prior to launch) is yet another of AMSAT's so-called "Microsat" series of spacecraft. Weighing in at a rather hefty 42.5 kilograms (93.7 lb), it was launched into a 97-degree inclination, sun synchronous polar orbit as an auxiliary payload aboard an Indian Polar Satellite Launch Vehicle (PSLV-6) on May 5, 2005 by the Indian Space Research Organization (ISRO). VO-52 shared the launch vehicle with CARTOSAT-1, an Indian Remote Sensing satellite, which itself weighed in at a whopping 1,560 kilograms (3,440 lb).

VO-52 was India's first-ever contribution to the international Amateur Radio community and was intended to bring ISRO's satellite services within easier reach of the common man while also popularizing space technology among the masses. What's more, VO-52 met a long-felt need for the Amateur Radio satellite operators in the South Asian region.

What's a Sun Synchronous Orbit?

As VO-52 (along with many other amateur satellites) share this type of orbits, it's important to know what this term means. A sun-synchronous orbit (sometimes called a heliosynchronous orbit) is an orbit that combines altitude and inclination in such a way that objects in that orbit appear over the same point of the Earth's surface at approximately the same local sun time each day. Satellites that need consistent lighting, such as those that image the Earth's surface in visible or infrared wavelengths (like weather and spy satellites) or for other remote sensing purposes (such as those carrying ocean or atmospheric remote sensing instruments) are routinely launched into sun synchronous orbits. And because VO-52 was launched as a secondary payload aboard a rocket that carried a remote sensing satellite, VO-52 ended up in the same relative sun synchronous orbit as the main payload.

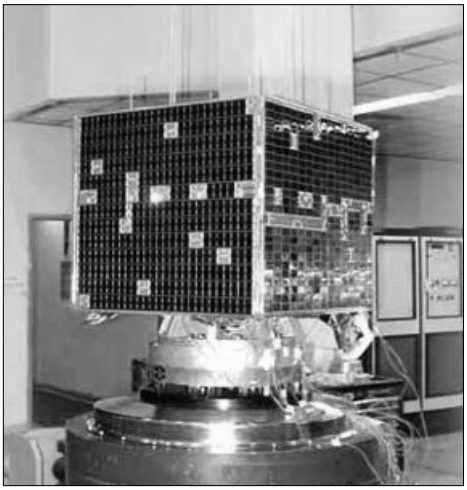

Photo 1: VO-52 sits atop its carrying structure just prior to integration into its PSLV-6 launch vehicle. (Courtesy: AMSAT-India)

Structure

VO-52 consists of a cube-like structure measuring 630 mm X 630 mm X 550 mm (25 inches X 25 inches X 22 inches) made up of aluminum honeycombs. Passive thermal control is achieved by spinning the satellite at a rate of about 4 RPM with a ±3 degree spin axis orientation. A tri-axial magnetometer with sun sensors and magnetic torquers act as actuators to provide the required inputs to the spacecraft's onboard electronics, all of which keep the satellite correctly oriented in space. Body mounted solar panels and COTS (Commercial off the Shelf) lithium-ion batteries provide the main sources of onboard power. Multi-element turnstile antennas are also shared between VO-52's transponders and for transmitting downlink telemetry.

Transponders

VO-52 carries two linear (analog) inverting transponders. William Leijenaar, PE1RAH, a Dutch radio amateur and graduate engineering student at the Higher Technical Institute at Venlo in the Netherlands, built the first transponder. Amateur Radio enthusiasts and others at ISRO built the spacecraft's other transponder.

Both transponders operate in Mode U/V (Mode B) with uplinks at 435 MHz and downlinks at 145 MHz (see table). An unmodulated carrier on 145.936 MHz identifies the Indian transponder while the Dutch transponder emits a CW signal on

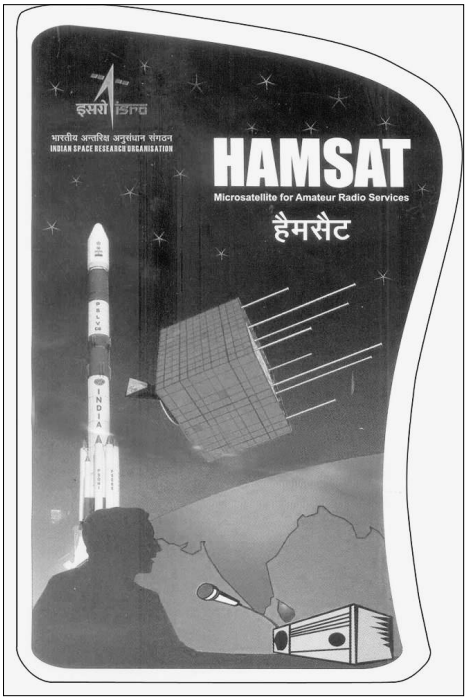

Photo 2: A sticker commemorating the launch of HAMSAT was widely circulated among Indian hams. The satellite later became VO-52 on orbit. (Courtesy: AMSAT-India)

145.860 MHz. The output power of both transponders is about 1 watt. Transponder bandwidth is approximately 60 kHz for the Indian transponder and 50 kHz for the Dutch transponder. Unfortunately, there's not enough spacecraft power to run both transponders simultaneously, so only one transponder can be activated at a time.

How, When and Where to Listen

Since its launch in 2005, VO-52 has become yet another popular linear (analog) Amateur Radio satellite. Its one-watt transponders and turnstile antennas provide surprisingly strong downlink signals … even for those using modest satellite antenna arrays.

However, because VO-52 is in a relatively low, 646 X 607 Km (about 401 X 377 Mile) orbit, it appears to be moving a lot faster than most other so-called low earth orbit Amateur Radio satellites. This translates into a somewhat smaller footprint on the earth, somewhat reduced access times (on the order of only about 15 minutes or so on each pass) and far more noticeable Doppler shifts on both uplink and downlink signals. This also means that you'll need to keep a fresh set of Keplerian elements running in your satellite tracking software to make absolutely sure

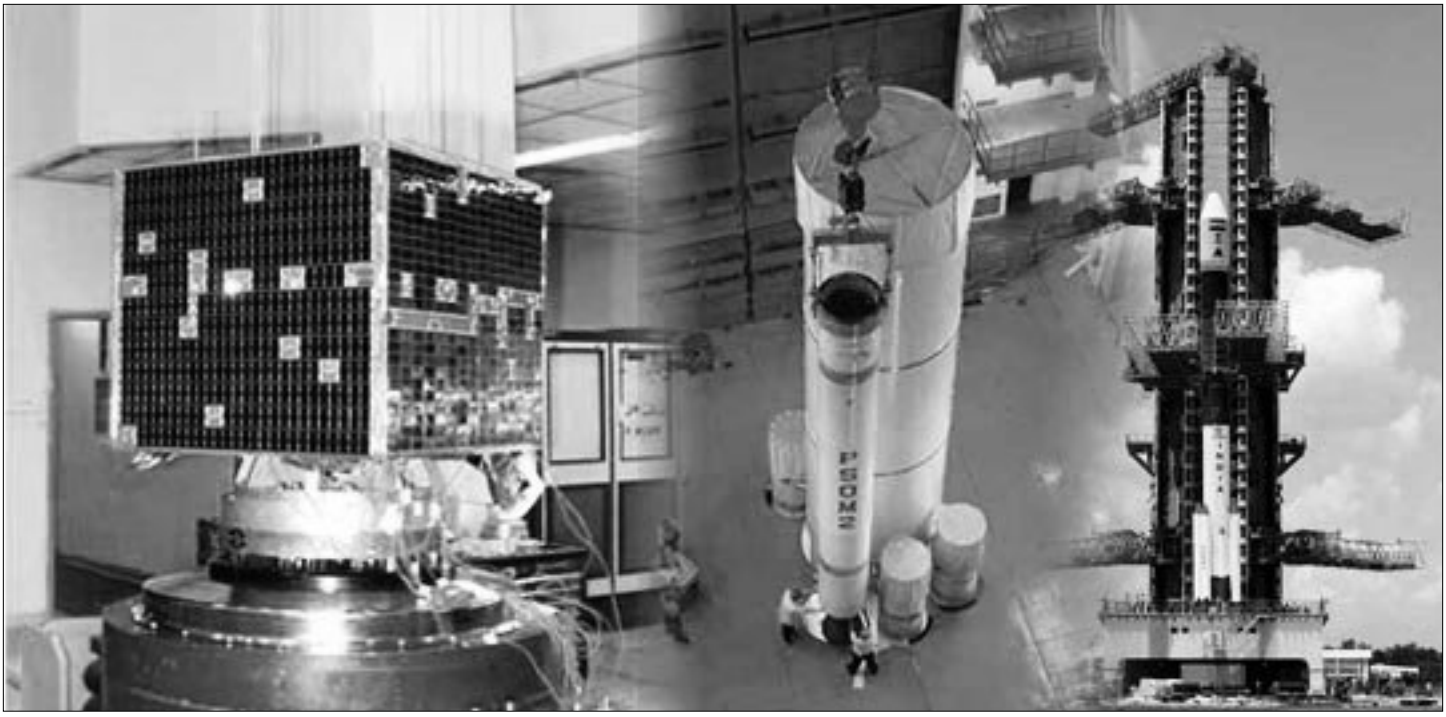

Photo 3: A photomontage showing VO-52 and its PSLV-6 launch vehicle prior to launch. (Courtesy: AMSAT-India)

your timing is correct to catch the satellite's entire pass at your location.

As with operation on our other linear satellites, when VO-52 first pops over the horizon, I set my downlink frequency in the middle of the passband (at, say 145.900 MHz) and then send a few widely spaced CW dits on the uplink while tuning the frequency of my uplink signal around. Once I hear my own dits coming back to me on the downlink, I immediately know I'm getting into the bird and I can then start actively looking for a contact.

At press time, VO-52's Indian ground handlers were experiencing some difficulty with one of the satellite's transponders and were running tests to track down the problem. So, don't be surprised if you discover that both of the satellite's the transponders have been switched off over your location. Just keep trying on another orbit (or on another day) and (hopefully) you will eventually be rewarded with a very pleasant contact through VO-52.

Clearly, our Indian and Dutch counterparts have done a superb job in building and launching this satellite. Hopefully, VO-52 will prove to be the first in a long line of satellites built and launched by AMSAT-India with the help of the ISRO. More information about VO-52 and AMSAT-India can be found on their Web site at: **http://www.amsatindia.org**.

Looking Ahead

That's all for this time. In future columns, I'll be keeping you up-to-date on all the latest developments in the fascinating world of amateur satellites as well as taking a look back at some interesting early history of various projects that first took Amateur Radio into space. See you then!

VO52 FREQUENCY AND MODE DATA:			
MODE	**UPLINK (MHz)**	**DOWNLINK (MHz)**	**BEACONS (MHz)**
U/V (Indian)	435.220 - 435.280	145.930 - 145.870	145.936 MHz (Carrier)
U/V (Dutch)	435.225 - 435.275	145.925 - 145.875	145.860 MHz (CW)