Sub-satellites: Part 1, Early manned-spacecraft-deployed

By Don Hillger and Garry Toth

What is a sub-satellite?
The term ‘sub-satellite’ has more than one definition. This article presents the different meanings of the term, and then concentrates on the type of sub-satellites of particular interest to the authors: those deployed from manned spacecraft.

Historically, one definition of sub-satellite is a satellite (artificial or natural) orbiting another satellite. At one time it was thought that some of the moons of the larger planets in the Solar System might have their own moons or rings. Except for satellites that have orbited Earth’s Moon, no artificial satellites have orbited the moons of other planets, although attempts to do this were made by the Russian Phobos-series spacecraft, none of which fully completed their missions (Phobos is one of the Martian moons). More recently, the Rosetta/Philae mission orbited and landed on a comet 67P/Churyumov–Gerasimenko, but that’s neither a planet nor a moon.

Another definition of sub-satellite applies strictly to artificial satellites released from another spacecraft in orbit. In the simplest case this can be the sub-parts of a spacecraft that separate from each other. An early example was the Explorer-65/AMPTE (Active Magnetospheric Particle Tracer Explorer) mission, launched in 1984. AMPTE separated into three parts, the CCE (Charge Composition Explorer), the IRM (Ion Release Module), and the UKS (United Kingdom Sub-satellite). Note particularly that “sub-satellite” is one of the spelled-out words in the UKS acronym. For such sub-satellites, the orbits of the parts are not significantly different from the orbit of the spacecraft before being split up. This type of sub-satellite is not discussed further in this article.

There are also sub-satellites which have been launched from other spacecraft, but with their own missions, often quite different from those of the mother craft. The majority of those types of satellites (about 100 of them) were launched with and deployed from the 135 Space Shuttle missions during its 30+ years of operations. For such sub-satellites, the Shuttle, rather than a conventional rocket, was the launch mechanism. Shuttle-deployed satellites are seldom referred to as sub-satellites, and are not the focus of this article.

It was with the advent of manned space stations like Salyut, Mir, and the ISS (International Space Station) that the use of the term “sub-satellite” became more common, referring to satellites deployed from those space stations. It is not well-known that a few sub-satellites were also deployed from the earlier Mercury, Gemini, and Apollo spacecraft. Some postal items do feature this category of sub-satellites. The remainder of this article will discuss those deployed from the earlier manned missions. Part 2 to follow will examine the sub-satellites launched from the manned space stations.

Mercury-deployed sub-satellites
Three sub-satellites were deployed from the Atlas-launched (single-astronaut) Mercury missions. The Mercury missions were the realm of the original 7 US astronauts, with missions numbered MA-1 (Mercury Atlas-1) through MA-9. Two tethered Mercury Balloons (or Mercury Balloon Sub-satellites) were deployed from Mercury MA-7 and MA-9, in 1962 and 1963 respectively. Those balloon sub-satellites were used to measure atmospheric drag and to determine the visibility of an object of known size and shape. The first balloon was ejected from MA-7 but failed to inflate properly and was not useful for either of those intended purposes. The second balloon failed to eject from the orbiting MA-9 capsule. However, on that same mission, a separate Flashing Light Unit (or Flashing Light Sub-satellite) was also deployed. It contained batteries and two Xenon flashlights to test the visual acquisition of other space vehicles by astronauts. No postage stamps are known to exist for the Mercury-deployed sub-satellites.

However, covers exist for these missions, but more often than not they include no mention of the sub-satellites that were deployed. For example, a Rank velvet cover for Scott Carpenter’s Mercury MA-7 mission is below, with no indication of the Mercury Balloon-1 sub-satellite deployed during that mission. In fact, the authors have found no MA-7 covers that feature that sub-satellite.

Rank velvet cachet on a Mercury MA-7 launch cover (from 24 May 1962), but with no indication of the Mercury Balloon-1 sub-satellite that was deployed.

Top of the next column is a Rank velvet cover for Gordon Cooper’s Mercury MA-9 mission showing what is called “Cooper’s Satellite” and “flashing beacon ejected”, which refer to the Flashing Light Unit sub-satellite. The second sub
-satellite, the Mercury Balloon-2 is not noted on the cover. A Sokolsky cover for the same MA-9 mission is shown below, but it does not give an indication of either of the sub-satellites.

Gemini-deployed sub-satellites

Only one sub-satellite, the REP (Rendezvous Evaluation Pod) was deployed in the whole series of 12 Titan-launched (two-astronaut) Gemini missions - the Rendezvous Evaluation Pod (REP), which was ejected from Gemini-5 in 1965. It was to be used as a target for simulated rendezvous manoeuvre experiments. It contained a radar transponder, flashing beacons, batteries, and antennas. Although ejected properly from the orbiting Gemini-5, the rendezvous plans were abandoned because of fuel-cell problems aboard Gemini, leaving the REP in orbit but unused.

No postage stamps are known to show the REP. The above right Rank velvet cover for the Gemini-5 mission (Gordon Cooper and Pete Conrad were aboard) does mention it, however.

Apollo-deployed P&FS (sub-satellites)

The only sub-satellites launched from the many Apollo missions were the two Particles and Fields Sub-satellites (P&FS) deployed from Apollo-15 and 16, in 1971 and 1972 respectively. Each P&FS orbited the Moon for some time after being ejected from the Apollo Command and Service Module (CSM), which orbited the Moon while the Lunar Module (LM) descended to the Moon’s surface with two astronauts and returned them again to the CSM.

P&FS and Apollo Command/Service Module (CSM) orbiting the Moon

The two P&FS were designed to study the plasma, particle, and magnetic field environment of the Moon, as well as map the lunar gravity field. They were deployed using a spring-loaded mechanism in the CSM bay. On each P&FS three deployable booms were attached to a hexagonal cylinder, with one of the booms being a magnetometer and the other two booms providing balance. The initial spin rate of 120 rpm upon ejection was slowed to 12 rpm after extending the booms. The first (Apollo-15 deployed) P&FS operated successfully for about 6 months before experiencing an electronics failure. However, it continued to orbit the Moon for another year after that. The second (Apollo-16 deployed) P&FS impacted the Moon after only 34 days because it was released into a less desirable orbit.

P&FS on postal items

The P&FS pair are the most common sub-satellites to be found in postal items. A few are shown below. For the
complete list of the P&FS items, see the links at the end of this article.

All but one of the postal items included below were issued in 1971 or 1972, the same years as the two P&FS missions. Most of them were issued by the Trucial States (Ajman, Fujeira, Ras Al Khaima, and Sharjah), but a few other countries also contributed P&FS items, most notably Romania in 2000 as part of a sheet of 6 stamps for the Expo 2000 Stamp Show. Also featured on several of the stamps is the Lunar Roving Vehicle (LRV) or “moon buggy” that was also part of the Apollo-15 and 16 missions (it was also part of the Apollo-17 mission which did not include a P&FS sub-satellite).

**Ajman State**
Michel 1260A and 1262A, 1972

**Fujeira**
Michel 835A, 1972

**Equatorial Guinea**
Michel 23, 1972. This stamp was also overprinted as Michel 1497 in 1979

**Ras Al Khaima**
Michel BL131A, 1972

**Romania**
Scott C188, Michel 3022, 1972 and right Romania Scott 2394 and C192, Michel 3076 Below BL102, 1972
P&FS deployment covers

There are also a number of covers for the deployment of P&FS from both the Apollo-15 and Apollo-16 missions. Only one cover will be shown here for each P&FS mission, plus an insert from another cover. To see additional deployment covers, the reader can refer to the P&FS link below, where all covers known to the authors are found.

More sub-satellites to follow in Part 2

This Part 1 has discussed sub-satellites deployed from early manned spacecraft: the Mercury and Gemini-deployed sub-satellites as well as the philatelically-well-represented Apollo-deployed P&FS (sub-satellites). Part 2 will cover sub-satellites which were deployed from later manned space stations, for most of which there is only a limited amount of philatelic documentation.

Additional online information

A checklist of Mercury and Gemini-deployed sub-satellites is available at http://rammb.cira.colostate.edu/dev/hillger/Sub-satellites.htm, and a checklist of Apollo-deployed P&FS (sub-satellite) postal items is available at http://rammb.cira.colostate.edu/dev/hillger/P&FS.htm. The authors would like to hear from anyone who knows of additional postal items that may have been missed. E-mail correspondence with the authors is welcomed, using the addresses below.

Biographical notes

The authors have researched and written extensively on the subjects of weather, climate, and unmanned satellites on stamps and covers, as well as other topics. For a complete list and electronic reproductions of those publications, see http://rammb.cira.colostate.edu/dev/hillger/stamp-articles.htm.

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