Working the Japanese Amateur Radio Satellites

by Keith Baker, KB1SF / VA3KSF, kb1sf@amsat.org

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In previous columns, I've been showing readers how to equip their stations, watch for, track and then (for those so licensed and equipped) actually work through our various Amateur Radio satellites now in orbit.

In this installment I'll be turning the spotlight on to a whole series of Amateur Radio satellites that were built, launched and controlled by our friends in Japan. One of these satellites still remains semi-operational to this day.

The FUJI Satellites

The very first Japanese Amateur Radio satellite, JAS-1a (which later became Fuji-Oscar 12 on orbit) was launched on August 12, 1986 on the very first test flight of Japan's new H-I launcher developed by Japan's National Space Development Agency (NASDA). It was part of a piggyback payload that rode into a nearly circular, 1497 x 1479 Km, Low Earth (LEO) orbit along with a Japanese experimental geodetic satellite called AJASAI (EGS). The FO-12 satellite consisted of a 26-sided polyhedron (about the size and shape of a medium-sized beach ball) and weighed in at about 50 Kg.

Figure 1: Technicians put the finishing touches on the launch mechanism of JAS-1b, a linear transponder-equipped satellite that later became FUJI-OSCAR 20 (FO-20) in orbit. (Courtesy JAMSAT)

FO-12 was the first Japanese amateur satellite developed by the Japan Amateur Radio League (JARL) with system design and integration performed at Japan's NEC Corporation. Unfortunately, eclipses kept FO-12 from producing enough electricity to keep it switched on for an entire orbit and it was eventually taken out of service on November 5, 1989 when the battery failed.

JAS-1b (Fuji Oscar 20)

Fortunately, Japanese hams had a replacement satellite ready for launch three months after FO-12 had to be turned off. JAS-1b became the seventh Amateur Radio satellite hurled to space in 1990 and was renamed Fuji-Oscar 20 soon thereafter. Another H-I rocket provided by NSADA ferried the 50 Kg. JAS-1b to a 750-mi.-high orbit on February 7, 1990. This H-I also carried two government satellites, MOS-1b and Debut and it marked the very first time Japan had launched more than two satellites at one time.

There were many positive features of FO-20. Its orbit was somewhat more elliptical than the most other LEO amateur satellites, so it often provided a somewhat larger footprint at Apogee and, therefore, a much larger area for potential contacts. I made many enjoyable contacts though this satellite, once I got used to FO-20s very rapid Doppler shift on the 70 cm downlink.

The Benefits of Mode J

But the 70 cm downlink was not without its benefits. Indeed, for those who were so equipped, the 70 cm downlink of FO-20 provided many users with a way to escape the inherent man-made noise that is often present on both 10 and 2 m, which, up to that point had been the "traditional" downlink frequencies for most of our Amateur Radio satellites. In many areas of the world, the 2 m band is so crowded (or filled with electrical and other noise) that it makes satellite weak signal work nearly impossible. Most of this interference is not present at 435 MHz, and

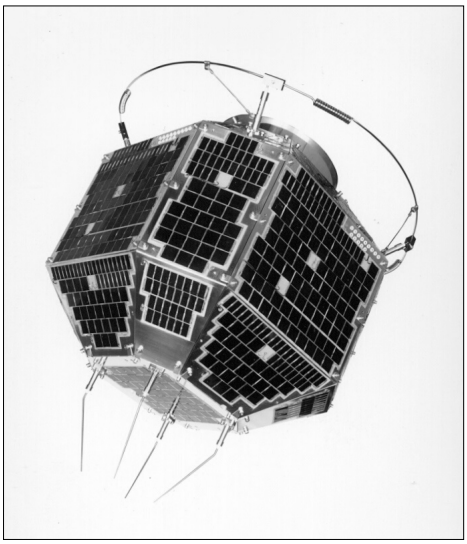

Figure 2: JAS-1b (FO-20) as it might have appeared in orbit. (Courtesy: JAMSAT)

spectrum space is somewhat less crowded at that frequency. So Mode J operation (2 m up/70 cm down) is often much preferred to Mode A (2 m up and 10 m down) or Mode B (70 cm up and 2 m down) in those areas.

Unfortunately, for all of its positive aspects, FO-20 is no longer operational. However, once again, before it went silent, our Japanese compatriots had a follow-on satellite, JAS-2 built and ready for launch.

JAS-2 (Fuji Oscar 29)

JAS-2 was successfully launched by NASDA, the Japanese National Space Development Agency, from their Tanegashima Space Center in southern Japan in August 1996 to become Amateur Radio's first new orbiting satellite of that year. As with their previous satellites, JAS-2 was principally designed by a team from the Japan Amateur Radio League (JARL) and was later built almost entirely by NEC under contract from JARL. Soon after JAS-2 successfully reached orbit, JARL requested that an OSCAR number also be assigned to their handiwork by the worldwide AMSAT community. The name Fuji OSCAR 29 (or just FO-29) was quickly

FO-29 FREQUENCY AND MODE DATA		
MODE	**UPLINK (MHz)**	**DOWNLINK (MHz)**
SSB/CW - JA	145.900 - 146.000	435.900 - 435.800

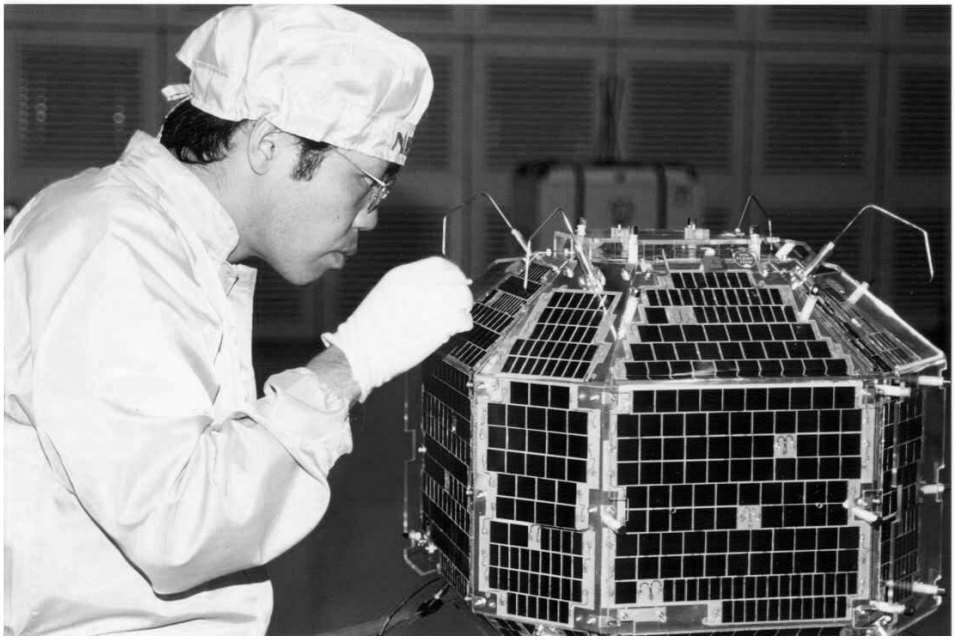

Figure 3: A technician makes a final adjustment to the JAS-2 satellite prior to launch in 1996. Later re-named FUJI-OSCAR 29 (FO-29) on orbit, the satellite is still "semi-operational" to this day. (Courtesy: JAMSAT)

given to the new satellite.

FO-29 contained both an inverting linear as well as packet radio transponder on board. It also contained a magnetic torque system to spin stabilize the satellite in a planned attitude perpendicular to the orbit's plane.

When its Mode J linear transponder was activated soon after launch, FO-29 provided very strong downlink signals, much stronger, in fact, than its aging FO-20 cousin. Also, FO-29 tended to strongly favor either left-hand or right-hand circular polarization depending on how the satellite was oriented with respect to the Earth.

Besides the stabilization system, there were many other electronic improvements carried aboard FO-29. The most obvious improvement was that, in addition to a 1200 bps AX.25 packet modem and BBS system, FO-29 also sported a 9600 baud FSK transponder as well. There was also a "digitalker" on board that stored and repeated about 25 seconds of speech unlinked from the FO-29 command station for later "broadcast" via the 435.91 MHz FM downlink. When its digitalker was activated, I still remember hearing it come over the horizon repeating the phrase "This is JAS 2" over and over again in a digitized female voice. Another, less obvious improvement included the use of gallium-arsenide solar cells with a much higher (17%) efficiency than those carried on other satellites of the era.

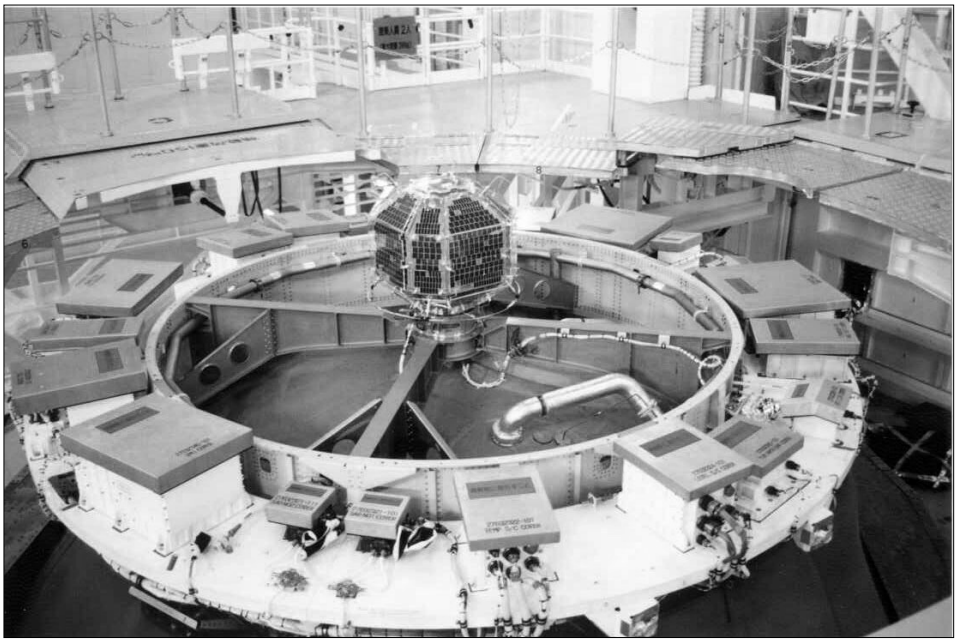

Figure 4: JAS-2 (FO-29) is dwarfed by its carrying structure. A Japanese H-II rocket launched from Japan's Tanegashima Space Center in southern Japan successfully placed the satellite into a circular, Low Earth (LEO) orbit. (Courtesy: JAMSAT)

Unfortunately, 15 years of exposure to the harsh environment of space has now taken its toll on FO-29 to the point that only the linear, Mode JA transponder is "semi-operational". It's been reported that the satellite's batteries are continuing to slowly fail due to long periods of darkness in some parts of its orbit. This condition has caused FO-29s ground handlers to keep the satellite completely switched off for upwards of several months at a time.

However, when it's activated, this satellite is still a pure joy to work through. Hopefully, we will get a few more years of use out of this old bird before it goes completely silent.

The latest on-orbit status of FO-29 is always available via the AMSAT Web site at: **http://www.amsat.org/amsat-new/satellites/satInfo.php?satID=5&retURL=/satellites/status.php**

Looking Ahead

In future columns, I'll be shining the spotlight on yet another group of our Amateur Radio satellites. See you then!