HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

When Tony England WØORE went to orbit on STS-51 on July 29, 1985, he took the usual SAREX (Shuttle Amateur Radio EXperiment) gear for two-meter voice contacts, but he also included some exciting extras. He had a complete two-way SSTV (Slow-Scan TeleVision) station. SSTV has been around for 30 years. It is a communications mode that sends and receives images using standard audio bandwidth. The signals can be put into a rig via the microphone jack and received through the speaker or headphone connection. SSTV had been used via OSCARs (Orbiting Satellite Carrying Amateur Radio) many years before Tony's trip, but this was the first time for two-way SSTV activity between a space-based ham and those on the ground.

The STS-51 SSTV gear consisted of a SAREX-modified Motorola MX-340 HT, a window-mounted two-meter antenna, Panasonic camera and monitor, Robot 1200C SSTV scan converter, Sony tape recorder and a custom headset. The gear worked well and those with appropriate equipment could receive and view pictures from the shuttle. At the Johnson Space Center in Houston, Texas, a group photo of the astronauts' wives was sent to the shuttle via SSTV. Tony captured the color image and resent it back to earth. The wives had made a round trip to space and back. Those monitoring the two-meter downlink saw this picture along with the many others sent from Tony and the crew.

Only a year after Tony England's ham activity from the space shuttle *Challenger*, the first major component of the Soviet *MIR* space station achieved orbit. Within two years, a full-time, two-meter ham station was onboard. Later, with the addition of a packet terminal node controller (TNC), signals from *MIR*—either voice or digital—were a daily event. *MIR* had an outside antenna and could run more power than the space shuttle. Signals were excellent.

Today on the *MIR* show

A few years ago, a group of hams got together to discuss the possibility of getting SSTV onboard *MIR*. They included Don Miller W9NTP, Farrell Winder W8ZCF, Hank Cantrell W4HTB, Dave Larsen N6CO and Miles Mann WF1F.

In June 1998, Miles Mann arrived in Moscow with three complete SSTV systems for delivery to Energia, the Russian organization that built *MIR*. Six months later, in December, the SSTV system was in orbit and on the air. Miles represents a group called MAREX-NA (Manned Amateur Radio Experiment—North American Division). This organization was created a month earlier as it split off from MIREX (*MIR* International Radio Experiment). According to Miles, MIREX handles QSL cards and some system operator duties, while MAREX-NA builds and flies amateur radio projects for the Russian space station. Information about MAREX-NA can be found on the Internet at [http://marex-na.org/].

The *MIR* gear

The *MIR* SSTV system is very compact and functional. It consists of a stack of electronic devices including a TASCO SSTV system with a color LCD (liquid crystal display) screen, a Kenwood dual-band (two meter and 70 cm) TM-V7A mobile FM transceiver, a custom controller box, an infrared remote control unit and an Apple Computer CCD (charged coupled device) color TV camera. The system is capable of

Photo A. *Slow-Scan TV from* MIR *with Soyuz TM-28 crew. Gennadiy Padalko (flight engineer) and Sergei Avdeyev (flight commander).*

Photo B. *A chocolate bear floats in front of the SSTV camera for a shot in December.*

Photo C. *The MIR-26 mission logo as seen via SSTV from* MIR.

Continued on page 44

Photo D. *With the camera aimed out the window, great views of Earth have been sent via SSTV from* MIR.

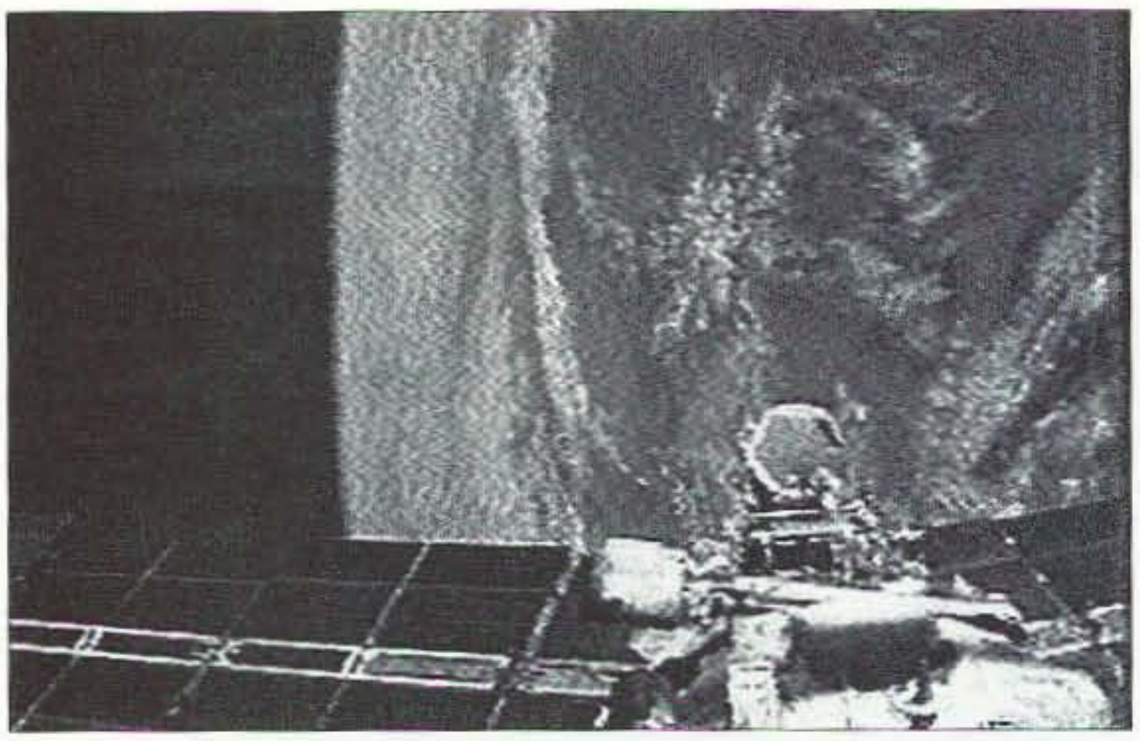

Photo E. *Solar panels in the foreground and the Earth in the background, as sent from* MIR *in Robot-36 SSTV.*

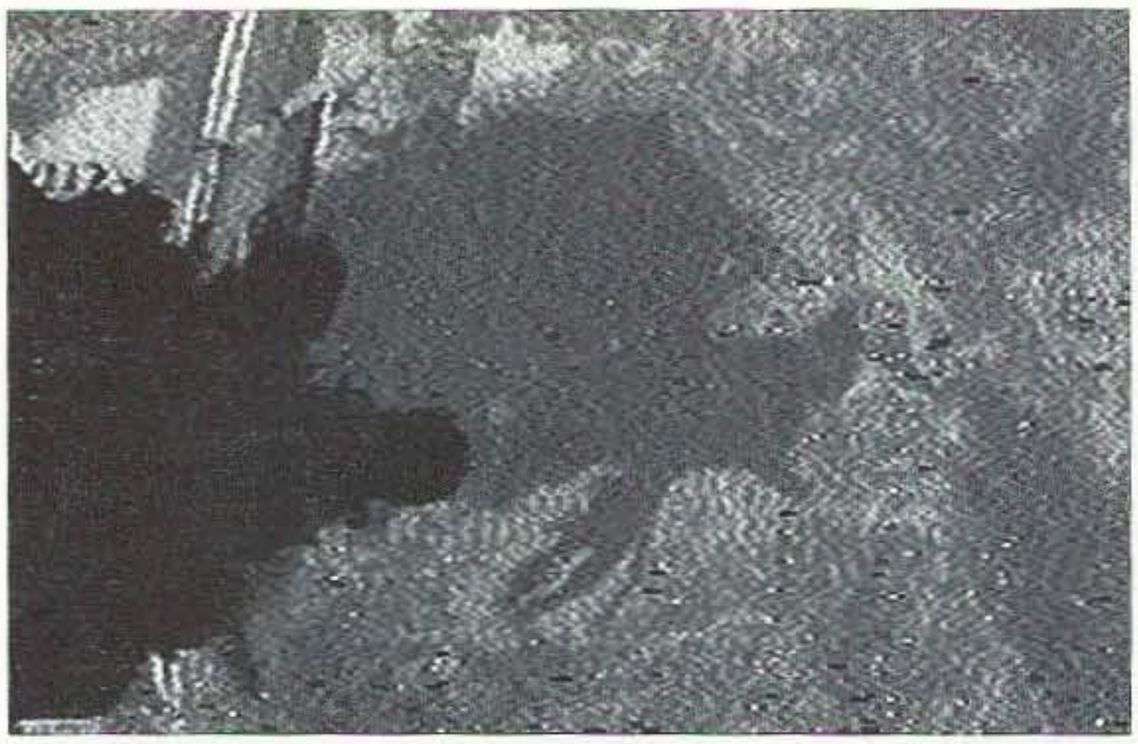

Photo F. *A good shot of upper Lake Michigan as seen from* MIR *on a south-to-north daytime pass over North America.*

HAMSATS

continued from page 43

manual or automatic operation and can be used to receive as well as transmit SSTV.

In the automatic transmit mode, the system is set to snap a picture once every two minutes and transmit it with a CW identifier of RØMIR just before the first sync signals. This means that there are about 80 seconds of dead air between pictures. This is the predominant mode of operation and is usually run with the Apple camera aimed out a window, providing spectacular Earth shots during daytime passes. At night you get solid blackness unless the crew has aimed the camera at something inside *MIR*.

The primary operating mode for *MIR* SSTV is "Robot 36." This is the same mode that became highly popular during STS-51 in 1985. It is one of the color formats designed by Robot. The picture transmission takes 36 seconds to form a complete 240-line color image. Image quality is good, but this is not one of the more advanced SSTV formats. *The ARRL Handbook* carries a good description of how SSTV works and definitions of the many modes currently in use.

The Robot 36 mode sends luminance and chrominance information in each horizontal line of the picture. This format is compatible with older black-and-white systems and provides a reasonably easy to receive and decode signal. It has been a popular format for SSTV operation via the hamsats for many years.

Receiving *MIR* SSTV

Due to various RF cabling problems on *MIR*, the SSTV signals have had to share time with the usual packet activity on 145.985 MHz. Originally, the SSTV was supposed to use 437.975 MHz. If time allows for *MIR* cabling changes, SSTV may yet be found on this 70 cm frequency, but for the first few months of operation, two meters was used exclusively. While packet proponents have voiced their complaints, the new crew of SSTV enthusiasts has been delighted with the results. Packet has been on predominantly during the week, with SSTV on the weekends. Doppler shift on 70 cm is three times worse than that on two meters, so pictures are easier to collect on the lower frequency.

A simple omnidirectional vertical antenna (like a ground plane) can be used in conjunction with a standard FM scanner to pick up the SSTV signals from *MIR*. A good two-meter transceiver with a rotatable beam will do better, but many fine pictures have been received and viewed on minimal systems.

It is best not to decode the signal while *MIR* is passing by, but instead to record the strange audio tones during a pass, and then decode them afterwards. During STS-51, it was common to collect images on cassette recorders for later playback. Today you can do a much better job if you have a hi-fi VCR. Connect a good quality video signal into the external video jack. You can get this from a TV with a video output connection or another VCR set up in a similar fashion. Connect the audio from your scanner or two meter radio to the left external audio input on the hi-fi deck. Set the VCR to SP (Standard Play) mode and hit record when *MIR* signals are detected, usually by watching the TV that now has your radio signals coming out of the speakers. Using a low-power HT, you can annotate the process by transmitting on the *MIR* downlink frequency between pictures. You can identify things like the time and calculated latitude and longitude of *MIR* on the tape to help identify the pictures.

Decoding *MIR* SSTV

In 1985, it was an expensive proposition to set up a home station for color SSTV reception. A Robot 1200C scan converter was needed to get good pictures. This could cost over $1000. Some simple software had been developed to decode black-and-white pictures on PCs of that time, but the results were rather dismal. The audio SSTV signal was typically connected to the PC via the cassette input jack. The resultant picture was quite grainy and hard to discern.

Today there are many ways to view SSTV. One is to get a TASCO scan converter like that on *MIR*. Most units cost about $400. Another is to use the

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

Photo A. *Kevin Hunt WA7VTD (center) and Dick Fredrickson WAØDIM (right) congratulate Southern California foxtailer J. Scott Bovitz N6MI at the closing banquet of the first Portland Friendship Games in 1991. Kevin and Dick are still officers of FARS, which is putting on FRG-99 and the Region 2 ARDF Championships.*

Dayton, Portland, and South Texas

Is hidden transmitter hunting the fastest growing activity in ham radio? I don't know for sure, but if my correspondence log is any indication, it's getting more popular every month. More and more hams are discovering the fun of on-foot international-style foxtailing (also called radio-orienteering or ARDF) and traditional mobile radio direction finding (RDF) contests (T-hunting or bunny hunting). Whichever type of transmitter hunting you prefer, there's lots of news for you this month.

The 1999 Dayton Hamvention's Fox Forum promises to be the best ever. Here's your chance to meet with RDF enthusiasts from all over the country. This year's organizers are Dick Arnett WB4SUV, Bob Frey WA6EZV, and Jim Elmore KC8FQY. Beginning at 10 a.m. on May 15 (time subject to change), a three-ring circus of foxhunting will feature Joe Leggio WB2HOL discussing his home-brew RDF equipment projects, followed by yours truly's slide show on mobile T-hunting, California-style. Then Dale Hunt WB6BYU will describe the excitement of international-style foxhunts, from last year's World Championships to the upcoming multi-nation event in Oregon.

The fun resumes after lunch, when it will be time for you to chase radio foxes for fun and prizes. Dick, Bob, and Jim aren't saying much about what to expect, except that it will be a challenge to both new and experienced RDFers. Bring your on-foot two-meter RDF gear to use and your mobile T-hunt setups to show off. I'll have my camera.

Crowning champs in the Beaver State

Preparations are in full swing for the upcoming biggest radio-orienteering event in the Western Hemisphere. Never before have hams in so many countries made plans to compete in a foxhunt on US soil. The first International Amateur Radio Union (IARU) Region 2 ARDF Championships will be part of the sixth biennial Friendship Radiosports Games (FRG-99), sponsored by the Friendship Amateur Radio Society (FARS).

I have explained the rules of radio-orienteering many times before, so here are just the basics for new readers: Five "fox" transmitters are placed in a large, woodsy park. They are all

---

sound card in your computer in conjunction with appropriate software to capture the images. A good list of available options, both hardware and software, can be found at: [http://www.ultranet.com/~sstv/download.html]. A favorite among *MIR* SSTV chasers has been Windows 95 SSTV (W95SSTV). A shareware version can be found at: [http://www.siliconpixels.com/W95SSTV/W95SSTV.HTM].

Most of the photos here were decoded with this software, using a reasonably current Pentium clone computer and a Sound Blaster-compatible sound card. The program is very easy to use even without reading all of the instructions. Jim Barber N7CXI and Bill Montgomery VE3EC did a really nice job. The software can be used on many SSTV modes and is capable of transmitting in addition to receiving SSTV. If you like the software, be sure to support the authors by registering your copy.

SAREX, SAFEX, MIREX, MAREX

Some confusion has been evident in hamsat circles regarding the state of manned spacecraft ham activities due to the growing numbers of players. SAREX is the Shuttle Amateur Radio Experiment group that was responsible for hams in space starting with W5LFL on STS-9 in 1983. They have been instrumental with activities involving school contacts with astronauts for many years. The group is still very much alive and is working closely with NASA, AMSAT and several related groups around the world to put serious ham radio on the International Space Station (ISS). Their project is appropriately named ARISS or Amateur Radio on the International Space Station.

SAFEX made its space debut as DPØSL in October 1985 on STS-61. DD6CF, DG2KM and PE1LFO operated a dual-band (two meters and 70 cm) system from the German SPACELAB module in the cargo bay of the space shuttle *Challenger*. SAFEX has been responsible for a number of shuttle and *MIR* experiments over the years.

MIREX and MAREX are relative newcomers. MIREX has been responsible for packet system advances on *MIR* and the scheduling of contacts and activities involving the *MIR* crew, school groups and others. MAREX has made great strides with the popular SSTV operation on *MIR*. Whether all the groups will be able to work together to advance ham efforts on manned spacecraft is unknown. In the meantime, we do know that what we now have in orbit is a limited resource. The crew on *MIR* was changed in late February. *MIR* is scheduled to be vacated in July if no funding is available to keep the orbiting outpost running. The Russian space station would then be brought back to Earth, rather violently, in August. Collect pictures while you can! 73