

The Rise and Fall of Amateur Direct Reception of Weather Satellites

Firstly I must thank NOAA for inviting an Amateur user group to speak and secondly on behalf of the Amateur community I would like to thank NOAA for its satellites and its help over the last 44 years.

Some of you may not be aware of the role that amateurs have had in direct weather satellite reception, or indeed who we are. The Remote Imaging Group was started 20 years ago in 1984 by Henry Neal in response to ordinary guys in the street who wanted to receive weather satellites. These people range from weather enthusiasts to radio and electronic hobbyists who find a challenge in the reception and display of the images. Whatever the original motive, most are fascinated by the weather and the ability to see it in real time.

In the 1990's it was estimated that in the reception range of Meteosat that there were 10,000 Private Individual Users of Meteosat (this figure was accepted by EUMETSAT), and that in the reception range of GOES 5,000 Private Individual Users. A total of 15,000 amateur users not including the Far East and Australia.

It is well known that the very first satellite was launched in 1957 and was the Russian Sputnik. But unbelievably just 3 years later the USA had not only a satellite, but one which sent down images of the earth never seen before ! This remarkable feat was documented in the August 1960 issue of National Geographic, and is available on their CD ROM. Luckily whilst visiting a school I managed to find an original copy. On the RIG stand outside there is a copy to look at.

By 1967 ATS was in a geostationary orbit sending images of the whole earth. In just 10 years the world had moved forward. I have had difficulty sourcing much information about amateur reception in the 60's, I'm sure it was present, but documenting in those pre-computer days was difficult.

In the 70's there were dozens of articles in magazines on how to build your own weather satellite station. From the obvious oscilloscope with a piece of photographic paper stuck to it, to home made Fax machines, modified Muirhead Fax machines and even using a car windscreen wiper motor to move a stylus over a piece of paper. These were the early days when receivers were not sensitive and a 6 foot long yagi antenna had to be tracked by hand outside in the garden.

The 70's stagnated a bit without any good way to display the imagery, but in the 80's all hell let loose ! In 1984 the BBC produced a computer for education aptly named the BBC Computer. It had some sort of graphics and a versatile user port to interface to. It was the start of the amateur use of computers for weather satellites, a reasonable display was achievable, but not really good enough for forecasting.

At the same time a German magazine produced a design of a Frame Store that took the data from a receiver and made it displayable on a television with up to 64 grey levels, this was extremely complex to build, but just about achievable. Great numbers of these were built, I would even go so far as to say several thousand. The design was versatile and coped with both NOAA Polar satellites and Meteosat and GOES geostationary satellites. A few commercial companies started to manufacture them, but there was an event on the horizon.....

And that event was the Commodore Amiga, the Atari ST and, wait.... Yes the IBM PC. Access to these computers was via the printer port and in the case of the PC an internal card. Here things started to get very interesting, for the first time the Amiga could actually automatically animate geostationary images, without any user intervention, and the displays were good enough for serious forecasting. The Amiga and Atari ST were short lived however, as the PC started to take control of the world.

Also RF technology had by now evolved to the point where one could make a 137MHz receiver out of a single IC, thanks to Motorola. FET's had become easy to use, and APT satellites could now be received on a simple non-directional antenna. Kits and designs flourished and standing out in the cold with an antenna in your hands was well and truly banished !

The PC started to dominate the graphic and easy of use front. Originally the EGA graphics were extendable with extra memory and a sort of grey scale could be synthesised with a few resistors and a monochrome monitor. The 8514 produced 1024 x 768 pixels with 256 colours and at the same time VGA came up with 640 x 480 in 16 colours or 320 x 200 in 256 colours or 16 greys.

So now in the middle to late 80's an amateur could get perfectly good weather satellite images on a very small budget. 137MHz APT receivers were easily built and Geostationary reception on 1691MHz with a loop yagi or small dish (made up of petals cut from a flat piece of aluminium) was relatively easy. The amateur now had it all, and the Remote Imaging Group (RIG) came into existence, what a milestone !

The late 80's saw better graphics from 3rd party video card suppliers, and soon the amateur could display every single bit of data transmitted by the NOAA APT and GOES & Meteosat geostationary WEFAX satellites. A huge achievement, and all for a few hundred dollars !

The early use of computers in schools was encouraged by governments all over the world. I was attending a NSTA (National Science Teachers Association) meeting in St Louis in I think 1987. Bob Popham from NOAA was helping me and we whiled away the days, however in the departure lounge ready to go home, Bob made a prediction that was beyond belief, he said "Dave within a couple of years amateurs will be receiving NOAA AVHRR HRPT images". How I pondered, you needed a tracking dish, and the data rate was faster than the frequency of a AM broadcast station. The received data could be said to be 1,000 times greater than APT, and to cap it all it was a orbiting satellite on 1707MHz with a Doppler shift of 35KHz. I got on a different plane than Bob and had a drink, or two.

In the pursuit of the education market my own company sent me to the NOAA Conference in Baltimore in 1988. There, to everyone's total surprise, John DuBois lectured on the first USA Amateur reception of HRPT. John had spent a lot of time and money developing his under \$1K system that actually rivalled other \$150K commercial systems. Remarkably John donated his research and design freely to the amateur community. The HRPT kit that RIG has made available has John DuBois to thank for. With manual positioning of the dish, an HRPT station could be home constructed for less than \$1K. The world was never the same after.

During the 90's RIG had over 2,400 world wide members, and reception techniques were refined and made easily by technology and evolution. It got to the point with semiconductors developed for mobile phones and satellite technology, that extremely small antennas could be used. Here is an antenna for APT (a six inch screwdriver), it's only good if held outdoors and on an overhead pass, but good enough with RF technology and image processing to give a possible image of your

immediate surroundings. And for Geostationary satellites, this small paperback sized antenna is perfect for a “mobile notebook in a brief case” to be used in any disaster zone within seconds of landing by helicopter. Out of interest, I demonstrated this Geostationary WEFAx antenna at the NOAA Conference in Washington in 2000. As PC’s got better and sound cards improved, a new breed of software emerged that allowed you to connect a receiver directly to the sound card, and with a modified radio scanner from Radio Shack (short out the IF filter), a coat hanger (antenna) and some public domain software APT was yours for under \$100 ! By the end of the 20th century the amateur had achieved everything that was possible, and some that was not.

So what has happened in the 2000’s ? The United States Government are threatening to charge for satellite elements, essential for the amateur to work out where the satellites might be. Meteosat MSG has failed and is now on a 11GHz relay, this is good news for price, but of the 10,000 users of the WEFAx data stream, less than 1,000 have migrated to the new and somewhat complex replacement. GOES is going the LRIT route with not a single home construction design in place, or even in the long term.

Is this the end of direct reception by the amateur ? I truly hope not. Amateurs enjoy the sheer challenge of direct reception, and that really means DIRECT reception, not via complicated 11GHz links. It has to be a challenge and fun. Hence I would sincerely ask NOAA for GOES LRIT and for future GOES satellites, if they could work directly with the Amateur community, and help them with designs and philosophy, in exactly the way they did in the early years, books with circuit diagrams, we just need a push. And we the amateurs, will be eternally grateful and continue with our unique contribution to the world of weather.

Guys, if you get time, come and have a look at the old stuff I have unearthed, or better still buy me a drink in the bar tonight or another night.

And lastly, thanks again to our hosts NOAA, for providing 44 years of fun, enjoyment and self training.

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