

## **Weak Signal Communications and Amsat P5A**

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**Recently AMSAT-DL is considering to participate in a mission to Mars. The question is not if this is within the amateur satellite service which it definitely is but how many radio amateurs will be able to directly participate in the mission ?**

**During the last 10 years computers became much cheaper than amateur radio transceivers. DSP analyzer techniques used with powerful processing power are becoming available in almost all amateur radio shacks. Computer memory and speed are no longer a restriction.**

**FFT Analyzer programs are available from many sources and provide a means to detect signals well below the noise floor of a receiver.**

**Weak signal communications improved due to modern semiconductor advances and these devices become cheap due to mass production of cellular radio and satellite equipment.**

**Tracking satellites with motor controlled antennas became common in today amateur satellite stations.**

**The amateur satellites increasingly make use of higher frequencies. Many have S-band and X-band capabilities.**

**The use of Internet is now widely accepted by radio amateurs for information flow and remote control of parts of amateur stations via the Internet.**

There is a way radio amateurs can directly participate in the mission to Mars. If we manage to persuade individual amateurs or small groups around the world to invest in weak signal communications a world wide Mars mission receiving capability would be possible to have simple almost 24 hours telemetry reception of the P5A satellite. Simple telemetry can use very slow techniques similar to Slowfeld or slowCW as used on the very low frequency bands. The use of modest antennas like a 2m dish and very low noise floor receivers would provide a signal that can be detected by a computer for most or all of the travel time of the satellite.

To achieve this some advance work needs to be done well before the Mars mission takes off. This is best achieved by preparing a good receive station and fine tune the DSP software needed to achieve decoding. The use of Amsat Oscar 40 once it has been operational could help in achieving a good receive station. In the old days a regular contest was held on Amsat Oscar 10 trying to detect the lowest possible signal transmitted by an amateur using the normal transponder up-link and using transmissions with different power levels. This sort of test on a regular basis could provide the tool for those of us who would like to prepare for the Mars mission . Unfortunately very few stations are active at this time on 10 GHz EME. Perhaps it is possible to organize 10 GHz EME tests in a second phase when the station is optimized for weak signal detection. A telemetry format could be tested on Oscar-40

and perhaps the Rudak experiment could be used to regularly send parts of telemetry in very low level transmissions. Most of the equipment is available to many radio amateurs. A Mars tracking program needs to be developed as well as the software to detect the weak slow signals out of the noise. As a start the currently available weak signal programs ( FFTDSP, etc...) could be used to tweak the receive stations equipment and antennas.

I recommend that radio amateurs who are not able to solve all of the problems involved try to find friends and form a small group to build a Mars mission receive station. I am sure many of these groups are already formed and work in the field of EME, Meteorscatter, contesting or Seti.

The above is only a short summary why the P5A mission to Mars would benefit all radio amateurs world wide. The challenge would be to follow the Mars mission as long as possible with a normal amateur radio setup and antennas and once the signal becomes unreadable for some groups to follow the mission with the use of remote stations on the Internet or using the audio available from the Internet to decode the signals. The use of computers is mandatory and perhaps the use of computer power and time could be enhanced using similar sharing techniques as the Seti group used to compute extra terrestrial signals with the idle time of individual computers connected to the Internet. These techniques may one day prove to be vital to establish communications between satellites and Earth. Radio amateurs and Amsat should stay at the forefront of these communication techniques.