

Documentation

Dave Typinski, March, 2015

As the saying goes, “no job is complete until the paperwork is done.” This was a lesson learned by all (we hope) upon their first trip to the bathroom. For me, the lesson was driven home even more when I became an aircraft mechanic. You can’t *touch* an airplane without filling out some kind of form – at least the FAA says you’re not supposed to, and for good reason. Screw up an airplane and people die, simple as that.

In radio astronomy, nobody is going to die if you mess something up or forget to document what you did. You will, however, feel pretty lousy when you realize all your effort was for naught because you got lazy and didn’t do the documentation and you have to do everything all over again. That’s a lesson we’ve *all* had to learn the hard way at one time or another.

If you design something, build something, change something, or make an observation, then documentation is very important. Documentation of failures is even more important – so you don’t waste time and money trying the same thing again.

An engineering log is one of the first things one should begin when starting out in radio astronomy. Two logs, even: one for observations you’ve tried and/or made, and one for the station hardware engineering. Observation logs are common in amateur optical astronomy, but unfortunately not so much in amateur radio astronomy. If your radio telescope runs 24x7 on autopilot, then the data itself can be an observation log. Otherwise, it is very useful to keep a log of what you observed and when you observed it, the prevailing conditions (lots of RFI?), the equipment used, and the results.

An engineering log is important because it lets you understand how the changes you’ve made to your telescope affect your observing success. Moreover, it allows you to look back and see what your configuration was when someone asks you what you used to get that really cool data three and a half years ago. This log should include things like antenna configuration, feed line loss, and receiver configuration – frequency, pre-detection bandwidth, gain settings, FFT parameters and anything else you can possibly think of. Going to all the trouble of setting up a nice, calibrated radio telescope without keeping an engineering log is a one way ticket to avoidable regret.

Then we come to the observing reports themselves. Just like they taught us in high school English class, you should document the five W’s: who, what, when, where, and why. The “how” is covered by the engineering log, but so what: put it in your report

anyway since anyone reading your report probably doesn't have access to your engineering log.

The report should be meaningful: your observatory location, who did the observing, what was observed, when it was observed, why you wanted to observe it, a description of the instrumentation used, a description of the data processing, and then of course a description of the results of your effort.

If the report is one among a series of ongoing observations, then a thorough write-up is not necessary until you tie them together with a more elaborate description and package it for publication. It is usually enough to log only the particulars of the observed emission, leaving most of the instrumentation description out of it if nothing has changed since the previous such report.

If the report is to stand by itself, however, then it should contain all the information necessary to allow someone else versed in the field to duplicate your results. That's simply how science works. For example, merely stating "we used a receiver tuned to 20 MHz with the AGC turned off" isn't good enough. What receiver? Make and model? Demodulation mode? Likewise, the data processing description must contain all the pertinent details. "We used FFT analysis" doesn't mean much if you don't describe the FFT parameters or the raw data. Same for data decimation and autocorrelation (data folding).

Plots used in the report should have meaningful axis labels, with units. A y-axis label of "Amplitude" is almost as bad as no label at all. Amplitude in what? Janskys? Candlepower? Decibels? (Relative to what?) Kilograms? Oompa-Loompas? Well, you get the point.

If you're making a claim of an uncommon observational feat – say, that you observed a radio burst from Zeta Reticuli at 146 MHz – then you should back up your claim with good evidence. Merely pointing at a bump on a plot isn't good enough here. You have to explain – *in detail* – why you think that bump represents Zeta Reticuli instead of a random fluctuation in the background noise.

Nobody is perfect – we all forget to log something here and there, and we all omit an important piece of information from documentation now and again because it seems "so obvious" at the time. Unfortunately, we nearly always regret it when we realize a few years (or days) later that the undocumented whateveritis is no longer so obvious.

In sum, if you take yourself and your radio astronomy efforts seriously, and if you respect yourself as an amateur scientist – or as a professional scientist, for that matter – then thorough documentation is your best friend. Sure it's a pain, but it's worth it. I encourage everyone to document as much as they can, whenever they can.



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