RADIO ASTRONOMY

Journal of the Society of Amateur Radio Astronomers

(SARA)

April/May 2008

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Published by the Society of Amateur Radio Astronomers
http://radio-astronomy.org

Society of Amateur Radio Astronomers – A membership supported, non profit [501 (c) (3)]
Educational Radio Astronomy Organization

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~ Giant Meter Radio Telescope ~



Figure 1: Two of the 38 wire dishes that make up the Giant Meter Radio Telescope (GMRT) in Khodad village, Pune, India, http://www.aavso.org/news/gmrt.shtml

Radio astronomy is searching exoplanets for decametric emission, like that seen with the Radio Jove system. More information on the GMRT is found in these sources:
(1) http://www.sr.bham.ac.uk/~samuel/publications/mru2007.pdf
(2) Astronomy & Astrophysics, *Predicting low-frequency radio fluxes of known extrasolar planets*, J. M. Grießmeier, P. Zarka, and H. Spreeuw (March 3, 2007) http://www.aanda.org/index.php?option=article&access=standard&Itemid=129&url=/articles/aa/abs/2007/43/aa7397-07/aa7397-07.html

~ The President's Page ~

Well folks this will be my last President's Page. I've decided to let someone else have a go at this for a while. I've held some office (Director, VP, Pres) in SARA continuously for almost 15 years now. We have a very capable Board, with most running for re-election if their term is up; I feel things are in good hands. I would encourage some new entrants though, as we can always use new ideas, perspectives, and enthusiasm.

Conference time approaches. We have a good collection of speakers thanks to Paul Shuch's excellent coercion skills. Check the website http://radio-astronomy.org for the latest details. I know gas is expensive. But it's an enduring experience being at NRAO Green Bank and their valley full of dishes, including the largest offset fed dish in the world, the 100meter Green Bank Telescope. And you too can learn to run a dish. As always we have use of the 40-foot dish during the conference.

But for those of you too far away to visit Green Bank, we are once again being assisted by NRAO's video conferencing group and hope to webcast the conference live. John Mannone should have details elsewhere in this issue, and on the website.

Those of you with optical astronomy as another facet of your interests, remember that StarQuest at NRAO happens directly following the SARA Conference. Make a family vacation week of it, in the wilds of West Virginia. http://www.greenbankstarquest.org/

It's been fun. I've seen SARA go from the days of trading chart paper for Rustrak recorders, to catching pulsars with Software Defined Radio. But now it's time to focus on my new job at DataPath, and catch up on my own radio astronomy and ham equipment at home. Like most, my "to-do" list is long.

***

If you are a member in good standing and will be absent from the 2008 Conference in Green Bank, please email in your vote to the Secretary, Karen Mehlmauer, secretary@radio-astronomy.org, in accordance with Article VII, Section 3 of the Bylaws, for your choice of candidates listed running for office elsewhere in this Journal. Please contact the Board if you have any questions. (*This note is entered by the Editor on behalf of the President*.)

Charles Osborne
K4cso@charter.net

~ Note from the Treasurer ~

SARA Membership Dues for 2008-9 are due on June 30th. Since we are going to an electronic-only Journal, the cost is only $20.00 per year. **Journal distribution requires a valid email address**. Recently, we have had to return several renewals to those subscribed to the hard copy version of the Journal, because they have not provided a valid email address. SARA apologizes for any inconvenience to its members who have been receiving the postal version of the Journal. Costs of this hard copy version now well exceed the Journal membership dues for this postal service ($24.00), necessitating the change to an electronic-only issue of the SARA Journal. Please send your dues to Tom Crowley SARA Treasurer 42 Ivy Chase Atlanta, GA 30342.

***

Hermitage is back in business after being closed last year. Their website stated, "Hermitage: back open under new management. P.O. Box 8, Bartow, WV 24920. Toll Free: (888) 456-4808; Direct: (304) 456-4808."

Tom Crowley, Treasurer

~ From the Editor's Desk ~

I encourage feedback and submissions (email blurbs to academic papers; hands-on project tips to analytical tools; etc.). New guidelines will be posted soon on the SARA website: [http://radio-astronomy.org/publicat/authjrnl.htm]. There will no longer be any restrictions on the length of articles. This is because *Radio Astronomy* will be available in full-color electronic only version. The only consideration will be compressed file size.

***

Please remember that late registrants to the SARA Conference will incur a penalty. Please remit the registration fee in full to the Treasurer by no later than Friday May 30, 2008. All registrations received after that date, including walk-in registrations, will be assessed an additional 15% late registration fee.

***

In this issue, you will find the particulars to see the live webcast of the conference in case you cannot make it to Green Bank this year. You should consult the January/February/March 2008 issue of the Journal for abstracts and scheduling information. Though it is the same information as on the SARA website, the Journal does organize the abstracts in the useful order of lecture appearance. In an insightful article, "Life Cycles," which uses the reverse of personification (would that be *stellarification*?), our president, Charles Osborne has some interesting words on personalities of people compared with star "types."

Our friends from "across the pond," ERAC, remind us of the utility and availability of sensitive fluxgate magnetometers. I had proposed the use of these devices to complement solar radio astronomy during the December 2004 Regional Conference in Arecibo, Puerto Rico. These devices will help correlate magnetic disturbances with solar activity monitored by GOES satellites, Radio Jove receivers, and SID receivers.

Explore the basics of radio astronomy with a homebrew microwave radio telescope very similar in design to the IBT. Mark Spenser of the ARRL lays out a series of experiments that exploit the principles of radio astronomy.

From our celebrated young astronomer appearing at the 2005 Conference, Shanni Prutchi, along with her father, David, demonstrate hydrogen radio astronomy at 1420 MHz doesn't have to be with a parabolic dish. They show that a stacked Yagi can be used with satisfactory results. Because of this work, a flurry of discussion on loop Yagi antennas appeared on the SARA listserve in late April and are collated here.

SETI has honored Tom Crowley. I have included the press release. In addition, read about SETI's invitation SARA members to join with their excellent incentives.

Ideas for group experiments are suggested at the end of the issue.

***

News alert: The "bambi listserve" has migrated to Google groups. On March 18, 2008, Bob Lash announced the following,

Hi all,

The SARA Discussion List has been running for many years an old 200 MHz Linux machine on my home DSL, and recently the machine has been exhibiting periodic disk errors.

To assure on-going reliability, our discussion is being migrated to the email list feature provided by Google. To minimize any inconvenience, I have automatically subscribed all 558 current subscribers of the SARA list to the new list. To post a message, send your email to:

sara-list@googlegroups.com (instead of sara@bambi-a.bambi.net).

Also, the list has a homepage at [http://groups.google.com/group/sara-list].

I believe that 4 of our participants have settings at Google that do not permit them to be automatically subscribed. If you have not received a message about the migration from the new list, you can manually subscribe at [http://groups.google.com/group/sara-list].

Please let me know if you have any problems with the migration. I will be out of town on vacation until Friday, but will be checking email again after that. I will keep the old list server running until everyone has settled in. You can always reach me at bob@bambi.net. Best wishes, Bob Lash, Maintainer of the SARA Discussion List.

SARA thanks you Bob for your managing this over the last 15 years.

***

Please welcome our new members who have joined since the last journal was issued:

Roger Bloor	Newcastle, Staffordshire, UK
Smith Philmore	West Springfield, MA
Sufitchi Ciprian	Chantilly, VA
Christopher Griffiths	Delaney's Creek, Queensland, Australia
Science Club for the City of Marion	Marion, In

***

John C. Mannone, Editor

~ Webcasting the Conference ~

Charles Osborne has established dialog going with Charlie Meyer in the IT department at Green Bank. He emphasized the usefulness of having a webcast of the conference. The number of participants would be proportional to how far in advance we could get the word out about its availability and how to do it. Charlie asked a few questions of NRAO-Charlottesville to investigate whether we can do video from the SARA conference again this summer. The outbound link from Charlottesville seems to be challenge for home viewers to lock onto. It is probably like "drinking from a fire hose" situation. Osborne suggested we dial it down a notch to be more in line with home DSL and possibly even dial-up users.

It's better to have home viewers get three good frames per second than *pixilated* ones, stop and catch up, jerky video and broken audio. I'll try to get him to setup a test prior to the conference if we can.

Here's some information SARA has received from Charlie regarding the broadcasting of the conference:

Video Stream address: mms://cod.nrao.edu:1800 (supports about 45 connections)

The video streaming format is Windows Media Video; playable on Windows, Macs or Linux computers with the required codec installed (e.g., in Windows Media Player, VLC for Mac/Linux, or mp player on Linux).

It will be streamed by our video conferencing system rather than a video camera as we've used in the past. We've never made use of this system before, so we don't know if it has the same ~10 second delay that our broadcasts have had in the past.

Just for your information, it's our understanding that the broadcast can also be recorded (in case that's at all interesting to you).

Charlie Myers, cmyers@nrao.edu

~ 2008 SARA Conference Election Profiles ~

The current slate of officers and board members are summarized below together with the dates of expiration when the position may be challenged. The status of their office, as of the 2008 SARA Conference, is also posted and known contenders indicated.

President	Charles Osborne ('08)	Vacant
Vice President	Dr. H. Paul Shuch ('09)	In continuance
Secretary	Karen Mehlmauer ('09)	In continuance
Treasurer	Tom Crowley ('08)	Vacant
Board of Directors		
	Jim Brown ('09)	In continuance
	David Fields ('09)	In continuance
	Jeffrey M. Lichtman	Emeritus
	John Mannone ('08)	Intends to re-run
	Bruce Randall ('08)	Intends to re-run
	Kerry Smith ('08)	Vacant
	Larue Turner ('09)	In continuance
Directors at Large		
	Ed Cole ('08), AK	Intends to re-run
	Rodney Howe ('09), CO	In continuance

Concerning the forthcoming elections, I had requested of the Board the following:

In preparation for the pre-conference issue of our journal slated for April/May 2008, I would like to do a cameo on the candidates for the upcoming election; i.e., a picture, bio, list of SARA contributions, reasons why one feels he/she would be good candidate for office, whether they hold a position now or is running for one in June, etc. In this way, our membership would have had a chance to review the candidates who have expressed interest or who may anticipate a nomination. At the very least, I want to make some appropriate announcements in the forthcoming issue.

Thanks,
John

What follow are the appropriate responses.

Chuck Forster running for the President's Office



Figure 2: Chuck Forster

"In response to your request [I am offering the following:

I would like to offer my services and run for the position of President of SARA.

Some background relative to SARA:

I've been a member since 1985.
I was president for 4 years after Jeff, SARA years (11-15).
I was vice president for a period of time.
Think I was Journal editor for over 5 years.

When we did the SARA receiver project, Jim Carroll designed the RX, Hal Braschwitz designed the antenna and I built all the units.

When I left office, we had several new ideas in mind for SARA, most if not all of these ideas have become reality, this is great!

Since I am mostly retired, I would have more time for SARA and I have no conflicting organizations to attend to. If out of state meetings are required, I could make those meetings, all at no cost to SARA.

The platform I would offer the group is as follows:

I would continue my original program to create sub-chapters in the SARA group on a worldwide basis. We should have an alliance with other organizations, but not dilute the SARA group, which has been in existence since 1981.

I would encourage more SARA regional meetings. I realize these are difficult to organize, but just a few members meeting at a place local to them could constitute a regional meeting.

I would ask the BOD to assign sub-committee chairpersons to people that have the time to be active in a particular sub-committee. In the past this assignment was more of recognition for past work, and some groups withered on the vine. We need a more significant way to recognize helpful members than just giving them more work to do.

Since last year I have looked into the idea of an "Elmer" type program that would make SARA members available to anyone needing a helping hand. I strongly support this idea, but with the way the world is today, SARA needs to be careful about sending SARA representatives out without some monitoring system. I would encourage a committee to examine this issue.

Last year I agreed to make and distribute SARA award certificates. I have not had any requests to issue a certificate. As president I would have more opportunity to find and recognize helpful members.

I think this is enough to promise for one term." Chuck Forster

Bruce Randall Re-running for Director

"It is my intention to run for board of director again. I have been a member of SARA for more than 15 years. WD4JQV has been my amateur radio call sign since 1974. I have been employed as an electronic engineer for over 30 years in analog circuit design and digital signal processing. This gives me some qualification in the technical support area. In addition, the SARA Journal has published several of my articles and I have presented several papers at SARA conferences. Most of my radio observing has been at the 408 MHz frequency." Bruce Randall

Ed Cole Re-running for Director at Large

"I would like to thank the support of the membership for last four years that I have had the privilege of serving as Director-at-Large. I hope that I have been able to make a contribution even though I am not always able to make the annual meeting and conference in Green Bank. I have written a little background information for those who may not know me.

I joined SARA in 1998 and attended the conference that summer and providing a presentation on an ionospheric experiment that I was involved in up here in Alaska. I have been a radio amateur since 1958 and this marks my 50th year as a ham. As a young

electrical engineering student at Michigan State University, I became interested in radio astronomy and convinced the Dean of Astronomy to permit me to do a reading course on RA my senior year. My favorite text was Radio Astronomy by John Kraus and the 72-page paper that resulted got me an introduction and invitation to study with Dr. Kraus. I could not follow that desire due to finances and pursued a career in Aerospace in southern California in 1968. That led to working at the Goldstone Deep Space Tracking Facility in the Mohave Desert for five years and three more years with Jet Propulsion Lab in Pasadena. Those were pretty exciting years in NASA with some well known probes (Pioneer, Voyager, Viking). I got the opportunity to work with a couple radio astronomers during that time (Radar Astronomy of Venus; S-band drift curves of Jupiter). I wasn't able to indulge in RA until joining SARA and the SETI-League.

I am also quite involved in ham radio EME (Moon Bounce) and microwaves. Probably my main interest is engineering systems and seeing them work. I have lived in Alaska since 1979. And I share my home with my wife, Janet, and seven dogs (six are sled dogs). I am currently building a 16-foor dish for 1296 MHz EME and 1420-MHz RA/SETI. I hope to provide a construction article this fall for the SARA Journal.

I would like to continue as your Director-at-Large."

John Mannone Re-running for Director

Ever since I saw the radio images of the spiral galaxies M81/M82, which showed their tidal interactions with streaks of hydrogen gas connecting them, I was hooked on radio astronomy. That was in 2000 when I started teaching astronomy and learned about the Chautauqua conferences in radio astronomy. I went to both of them in 2001 (MIT Haystack in May and NRAO at Green Bank in June). PARI had a small radio telescope workshop that year, too; I went to it as well (August). I learned about SARA and joined them in 2002. I have served on the Board for two terms (2004-2006, 2006-2008) and am running for my third consecutive term. I have served as the SARA International Ambassador since 2006, a tradition well facilitated as Journal editor. I have been Editor since November 2006 and have raised the quality and quantity Journal articles to new levels. I was instrumental in promoting an all-electronic journal. I wish to continue to serve SARA on the Board of Directors helping to raise awareness of issues and helping to raise SARA into an even better international entity than it already is.

Kerry Smith's Director position is vacant

Kerry is a long time supporter of SARA and his numerous contributions (including the IBT), whether serving as an officer or not, have benefited SARA. However, his intentions for re-election are unknown at the time of this posting.

~ Life Cycles ~

By Charles Osborne

I've been thinking about the various personality types that make up the clubs I'm involved with. There's always the core group of movers and shakers, which keep things going. I'll liken their personality types to star types.

Many of us are Main Sequence G-stars: normal folks just chugging through life's challenges. These members are the core of what makes a club work. They take a genuine interest, and do a variety of jobs, without aspirations of fame and glory, basically whatever needs doing. Year after year these G-Stars take new members, make them feel welcome, answer the beginners' questions, and point them toward good information.

Dark Matter, that mysterious invisible majority component of the universe has a similar facet in all groups. These are the people hiding in the back of the room, trying to become invisible like chameleons when volunteers or opinions are sought. You never hear from these members or realize they exist.

Then there are the Black Holes. These are rare but powerful. They are the naysayers and profits of doom for every potential new path the group might take. Like dark matter, they are normally invisible. But their power can suck the energy right out of the main sequence leaving everyone wondering what happened.

Others are Supernovas, the obsessive compulsives and type-A personalities among us. They blaze onto the scene and seem obsessed (or maybe possessed is a better term) with being all that they can be. But very quickly they realize they can't keep up the pace forever, and they disappear completely, rather than drop back to normalcy.

Life is a marathon, not a sprint. Try not to feel inadequate when the Supernovas flash and fade. It's the main sequence (and even the dark matter) that gives a club the mass it needs to continue. Contribute if you can. But don't worry so much about the cyclical nature of clubs. Our life and times mean we all contribute as best we can when we can. Pace yourself. I'm glad for each of your parts in this, big and small

On an individual basis, I've come up with a calibration thought to help us all figure out what is our real mission: "If you had only five years to live, what would you want to accomplish with your remaining time?" I see people obsessing over some pretty meaningless things sometimes. Others, through the power of choosing carefully what they do with their life, leave a lasting positive impression on those around them.

~ Radio Astronomy Toolbox: Fluxgate Magnetometer ~

This issue's radio astronomy toolbox comes from "across the pond." Peter Wright, ERAC President in Manheim, Germany, is promoting (see modified email below) a sensitive fluxgate magnetometer for correlation studies with solar activity. I had promoted this very thing during the December 2004 SARA Regional Conference in Arecibo, Puerto Rico. (The 3.6 Mb PPT can be downloaded from my "Adventures in Astronomy" website, http://home.earthlink.net/~jcmannone2/id2.html. There are a few slides on this device in the presentation, *Spectral Analysis Techniques in Amateur Radio Astronomy*.)

From: Peter Wright <erachq@aol.com>
To: discussion@eracnet.org
Cc: deborah@sun.stanford.edu
Subject: [erac] ERAC News Magnetometer
Date: May 18, 2008 8:42 AM
Attachments: Magnetometer.JPG

Hi group,

Here a very simple circuit for an FGM3h flux gate Magnetometer unit to detect variations in the Earths magnetic field. The Sensor is available for about 35 Euros directly from *Speakesensors* in Wales. Simply *google* the h-version, the special one we use. You need to call him to get the one that is 2.5 times more sensitive than the FGM3. I have bunched in allot of stuff (see the accompanying diagram), however all you basically need is the IC1 bit with the VFC32 from Analog devices set it for 5V at 10 KHz. This will give you 5V Swing cw and 5V ccw of the Sensor from east to west. It is very *very* sensitive indeed and I have a divide potential by two with the voltage divider R4 and R5 to give a 2.5V quiet field for my A/D Converter. This little sensor might be used to correlate X-ray activity from solar coronal mass ejections. In addition, it might be used to correlate sudden enhancement of a VLF signal (say with a SID detector).

The IC4 bit is an optical display giving full left 4.5V and full right 5.5V. This shows live movement with LEDs associated with IC2/IC3, but is a digital heterodyning bit to gives an audible sound and a blinking blue LED to see that the field is quiet. "You hear everything." It is great fun; I have built a vault in the ground using a cement pavement square, then a square cement tube and again a pavement square. This is great stuff and a wonderful killing object in the lawn for burglars to trip over and break their necks. More in the next NL.

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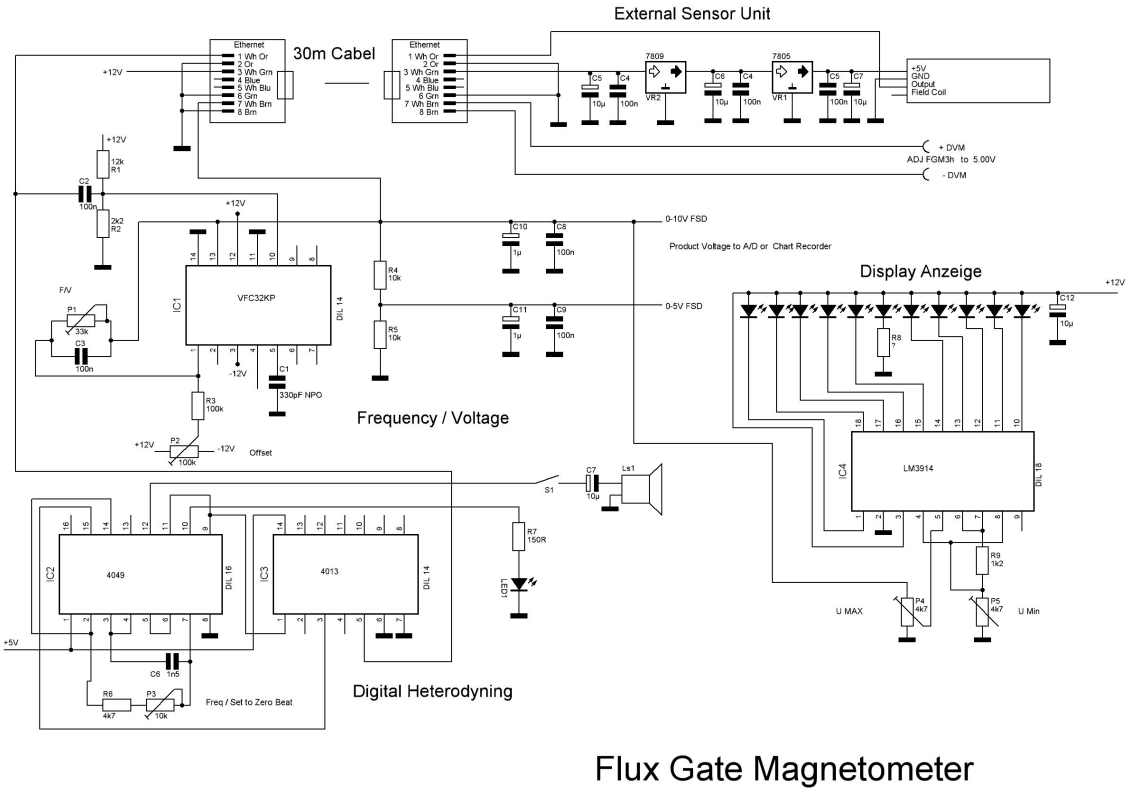


Figure 3: Flux Magnetometer Circuit (courtesy of Peter Wright, ERAC)

Here are some additional references to help us get familiar with the flux gate sensor:

http://ourworld.compuserve.com/homepages/demerson/magnet.htm
Fluxgate Magnetometer tests: FGM-3h
http://ourworld.compuserve.com/homepages/demerson/magtherm.htm
Thermal Effects & Long Term Drifts

http://www.magnetometer.org/mag-magnetoresistive.php

Just before going to press, I received more details from Peter and they refer to the circuit above. I have adapted his contribution to this Journal:

The design of the magnetometer is based around a very special sensor from Speake & Co that is cheap and very sensitive indeed from a very small company from Wales United Kingdom. If you look up their website at www.speakesensors.co.uk, you will find a whole lot of interesting stuff; however, not the Sensor I use here, which is the FGM3h. (the FGM3 is almost Identical).

The FGM3h is especially sensitive, about 2.5 times more sensitive than FGM3. The Dynamic range of FGM3h is about +- 0.15 orsted, about one third of the earth's magnetic field. This obviously means that the sensor must be mounted in an east west orientation (or the sensor will saturate).

Bill Speake from Speake Sensors is a very friendly man and he makes a large effort to supply his customers with as much information as possible. Give him my regards when you order.

The Circuit Design

If you look at the diagram above you will see the following: The FGM3h External Sensor unit is connected via a 30-meter 1:1 ethernet cable Cat 6 or higher, this gives a frequency variable product signal, which goes to the VFC 32 frequency to voltage converter, which gives you locally a DC voltage proportional to the magnetic field. This voltage then goes on in two directions, 0-10V, for any chart recorders you may like to use, as well as a very simple little LED display based on the LM 3914 bar graph display. The frequency product signal of the FGM3 is also used for digital heterodyning to give an optical as well as audio signal to interface with the operator.

The External Sensor Unit

The FGM3h is mounted on a small piece of *perf board* in 2.54 mm grid. The power supply is dual-regulated to get it very smooth, which may be a new approach to a few of you. The *perf board* is mounted in the plastic case around one setting screw, the case is roughly mounted East-West using a compass. Later, a fine adjustment is made by moving the *perf board* around its single pivot screw. One problem most sensors have is temperature drift. At the Radio Observatory in Mannheim, we have dug a hole in the ground and after pouring a cement foundation, we have used cement rings to build a vault in the ground. Do not use any steel or iron screws (or metal) near the vault or sensor. However, brass, aluminium or stainless steel is. Use also a magnet to detect any iron in things like resistor leads, since they sometimes are made out of copper plated steel. That's why I use TO220 voltage regulators, since they are all made out of copper. Bury the ethernet cable into the ground to protect it from UV Light Damage.

Frequency to Voltage Converter

The FGM3h produces a signal from DC to 20 KHz, the beginning; however, it does not follow a square law detector. I choose to have the zero position of the field so that, in East-West orientation, the FGM3h produces 10 KHz signal (mid range). Using a TTL square wave signal generator, adjust adjacent to the VFC32 (IC1) converter chip P1 for 10V at 20 KHz and use an offset on P2 to get the zero well within a few hertz. With this adjustment, we are looking for as much deflection as possible rather than exact values. The main thing is that, at roughly 10 KHz, you get 5V. The VFC32KP is a far superior frequency to voltage converter chip than the one suggested by Bill Speake from Burr Brown Analog Devices. It's also a bit more expensive, but worth it, the output goes to a divide-by-2 pad using R4 and R5, which should be 1% metal film type resistors. This converts the basic product into a 5V FSD signal for most A/D Converters. The original signal goes on further for a 1-10V output if needed. You might like to place here an LM358 non-inverting buffer amplifier if you wish to drive a mechanical instrument with a low impedance coil. Speaking of low coil impedance, pins 7 and 8 of the ethernet connector cable end in two test points. The 10V FSD signal is fed back to both pins so that you may connect a digital multimeter when adjusting electronics 30 meters away

from the sensor and you need to set East-West at exactly 5v. Do not goof up here by using a needle instrument with a built in magnet. (Also think about things like magnetic screwdrivers, credit cards with magnetic strips and the "very annoying" quartz arm band clocks with moving hands (every second, a micro EMP is emitted in all directions, so no Peter Pan clocks during adjustment!)

Digital Display

Imagine everything has been running nicely for a few weeks and the quiet earth's magnetic field has been registering on your computer or chart recorder. So you should know how many volts, plus and minus, are normal. It's now possible for you to calculate plus and minus to 0.5V and adjust P4 and P5 appropriately. Before you have found this out, however, a rough adjustment on the LED connected to pin 1 should make it light at 4.5V and the maximum LED voltage connected to pin 10 of the LM3914 should be 5.5V. If you look at the display for the LEDs, you will see that I have snuck in a middle LED, connected to R8, on my scale. I have 11 LEDs with the middle one permanently on the value for R, which you will have to select so that the brightness is what you like for a middle-value orientation lamp. I have adjusted my sensor so that the LEDs attached to pins 15 and 14 are just in difference to each other, both flickering as the voltage switch point slightly changes, here you have the midpoint exactly If you do not like running back and fourth, correct it a little bit with P4.

Digital Heterodyning

Now for something completely different as Monty Python would say, IC2 and IC3 have no exact function that is valuable to the success or failure of the experiment. No, they are the fun side of the Whole dammed set-up The gates connected to IC2 pins 2, 3; 4, 5; 6, 7 form a digital oscillator running at about 10 KHz. This should ring bells if you think for a minute! Our FGM3h produces 10 KHz in mid position of East West. And what do you suppose happens in a mixer? If you mix two almost identical frequencies together, you get the difference between them, which is in hertz, and multiples of hertz. Do this with square waves at 5V TTL level and you get out of the 4013 A/D flip-flop the difference from the Q output buffer. This, together with a few unused gates on the 4049 IC2, it is possible to drive a blinking LED (and a loudspeaker that could be turned-off with S1). Now, by almost zero beats, the little LED should be slowly blinking, and a clicking noise should be heard— a total cessation is a dream, unless you are running this in the Sahara Desert with solar cells. You will always be living with some magnetic field variations.

Observations

In the lab, it is very interesting to observe the LED bar graph display. I have used two red LEDs for the extremes, Pin 1 and Pin 10, followed by yellow ones. The two middle LEDs are green, Pin 15 and 14, and both left and right of the middle are red LEDs for positioning on the scale. In reality, the unit is so adjusted so that a quiet field allows the two middle LEDs to flicker, while the slightest variation in field causes one of the green LEDs to come on permanently, giving an instant indication of the direction of change. With further deviation in field, the next (yellow) LED starts to flicker, with the green one just on. With a bit more field variation, this yellow led comes on alone permanently and so on and so forth. An observation over a time of 10 minutes is enough to see that our

magnetic field is constantly jumping around— the planet is alive! With the digital heterodyning audio option turned on, a perfect zero beat might never be heard (perhaps in the Sahara Dessert), but a low growl is constantly there. If the tone changes, it's fun to identify the source. It may be a passing car or an aircraft flying overhead. Having made the magnetometer very sensitive, we suddenly had a new sense of perception of our environment. A little experiment I did was to go about 100 meters away with a magnet snapper from Ikea Shrank On opening and closing the metal plate (door), I could easily detect the magnetic pulses with the FGM3h. Even a quartz armband analog clock, as opposed to a digital one, could be detected with the second interval pulses.

After here mentioning the fun aspect of this wonderful little sensor, I do however have to return to reality. The sensor registers the impulses, but its main job is to register the Earth's magnetic field (and smoothly at that), which means that all the lights and buzzers in the electronic box are nothing other than for user entertainment! In reality, I take the 2.5V A/D converter signal through an integration pad to smooth out the results. A time constant of 0.5 to 10 seconds is a good measure to play with. I have installed a small internal switch to select the integration time, as well as allowing me to turn off the integration completely. The other day, I have used the FGM3h unit to give acoustic warning of meteors entering the sky around me with visual correlation to verify the unit is detecting them very well indeed. In the case of meteor observation, I have placed the output of the unit to the left side of a set of headphones and the audio output from a short wave receiver to the other. The short wave receiver is tuned to a weak station and when a meteor lights up the sky, both signals change together; as the event passes, the magnetometer returns to normal; however, the radio signal takes a little more time to return to normal because of the recombination time of the stripped ions – "nothing new to meteor scatter Hams." A very interesting aspect is to tune in a number of receivers to different frequencies: short wave, low VHF, high VHF and UHF. As a meteor passes, it ionises different layers (D, E and F).Each channel could be plotted together with the magnetic deviation channel. Therefore, you see that Ham radio science might be a bit more interesting than typical CQ, name the QTH and weather reporting type QSO!

Summary

I have kept the design very simple for a number of reasons. Firstly, I personally am sick to death with Atmel microcontroller applications, where people have obviously forgotten how to do analog circuit design.

I see that the proof of this magnetometer's usefulness is in data correlation, perhaps with a VLF sudden enhancement of signal detection (SID) and a multi-channel A/D converter, such as a Max186CCPP using software like Radio Skypipe.

This is a simple Breadboard Project that any beginner may build-up him or herself in an afternoon. And last but not least, it makes you think!

~ Homebrew Radio Telescope: Explore the Basics of Radio Astronomy ~

By Mark Spencer, WA8SME, ARRL Education and Technology Program Coordinator

(*Editor's Note: This article has been edited for space considerations*)

The foundation of radio astronomy is to study the heavens by collecting radio energy emitted by bodies in space, much like how astronomers collect visible light with telescopes. Sounds complicated, requiring very sophisticated and expensive equipment, but with some simple and inexpensive equipment, one can build a radio telescope that will allow you to learn and explore the fundamentals of radio astronomy.

In this article, a radio telescope (RT) was adapted from one of those ubiquitous [digital] TV Dish antennas. The RT project described here can easily be reproduced. It provides a wonderful learning opportunity.

The major components of the RT:

- modified TV Dish antenna mounted on a wooden support to allow pointing
- commercial satellite signal strength detector that displays the signal strength
- interface to convert signal strength to an AM tone fed into a computer sound card
- computer and software to display graphically the signal strength versus time

Since the TV Dish modifications are structural, any surplus TV Dish system can be used. The signal strength detector costs between $40 and $65 (widely available from web retailers). An easily duplicated interface circuit costs approximately $20. And the display software is free.

The following is a sample of experiments with this simple RT:

- Use the Sun to study and determine the beam width of the dish
- Verify predicted dish antenna performance
- Measure solar radiation intensity; detect changes in solar activity
- Measure relative changes lunar surface temperature
- Explore the drift scan method commonly used in radio astronomy
- Compare thermal emission of different emitting bodies
- Detect crowed satellites in the Clarke belt (geosynchronous orbit)
- Measure Earth's spin and orbital rotation

The basic RT system is based on the IBT (Itty Bitty Telescope[1,2]). The TV Dish is an offset 18" dish with down converter(s) mounted at the focal point of the dish. The down converter is called a low noise block (LNB). The LNB is a preamplifier/down converter that converts the satellite signals from approximately 12 GHz to 2.4 GHz. Most modern dishes have at least two LNBs to access several TV satellites simultaneously without changing the pointing of the dish. These LNBs share the common focal point of the dish.

But here, only one LNB is required. A minor adjustment to the IBT was made to position the single LNB at the dish focal point, which helps in pointing the antenna.

Use the existing LNB housing and its mounting bracket as a template to determine the distance between the edge of the mounting arm to the mounting hole of the LNB. I fabricated a new mounting bracket for the LNB from plastic. Though the dimensions are not critical, careful placement certainly will improve RT performance.

Some LNBs have two coax connectors. Since only one will be used with this RT, it is wise to terminate the extra coax connector with a 75-ohm dummy load to balance the load on the LNB. Dummy loads for "F-type" coax connectors are readily available from electronic parts retailers.

Counter intuitively, the dish is mounted upside down. Though not ideal for receiving satellite signals, this arrangement helps with pointing the dish as a radio telescope.

The satellite detector used in this project is the Channel Master (CM) satellite signal level meter model 1004IFD [3]. The CM is connected to the LNB. Power is supplied to the LNB through the coax connection from the CM. The CM detects the signal from the LNB. The meter gives the indication of signal strength. (It also varies the frequency of an audio tone to help technicians point the dish at the desired satellite.) As one moves the dish through the beam from the satellite, the meter will indicate an increase and then a decrease concomitant with the pitch of the audio tone. The IBT drawings detail how to connect

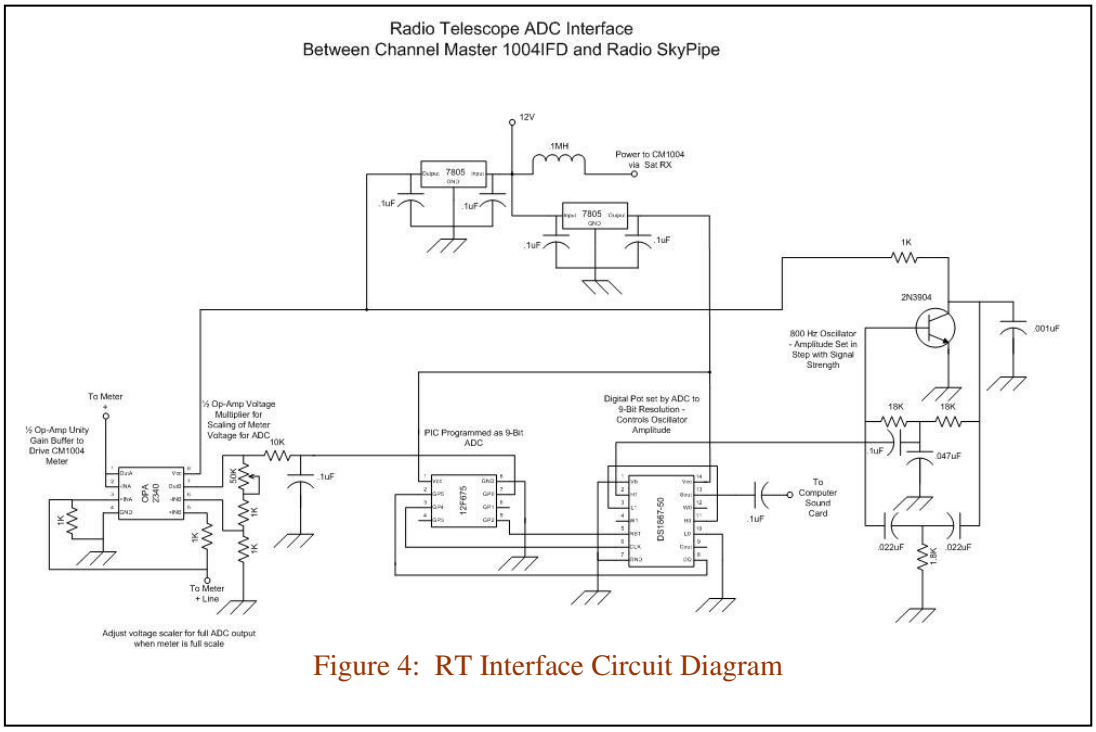


Figure 4: RT Interface Circuit Diagram

power to the CM, and in turn, to connect power to the LNB (the power connection effected via an interface described below). The CM meter and variable frequency tones

provide limited utility in detecting changes in signal strengths required for radio astronomy, nevertheless, they are somewhat effective,

.

The signals received by the RT are graphically displayed. An excellent software package called Radio Skypipe [4] displays the results on an electronic strip chart recorder. The free version of this software is adequate. Skypipe uses the computer sound card to digitize the incoming signal. It displays the signal strength versus time. Skypipe is very easy to use, but some study of the help-files will disclose the full capabilities of this software.

The Skypipe requires signals (audio) are fed into the sound card via a microphone jack. The output of the CM detector is an analog meter reading or a frequency modulated (constant amplitude) tone, which is not compatible with Skypipe, requires an interface.

Therefore, to make the CM output work with the Skypipe/sound card system, one must convert the signal into an amplitude-varied audio tone. The interface design and block diagrams are shown in figures 4 and 5.

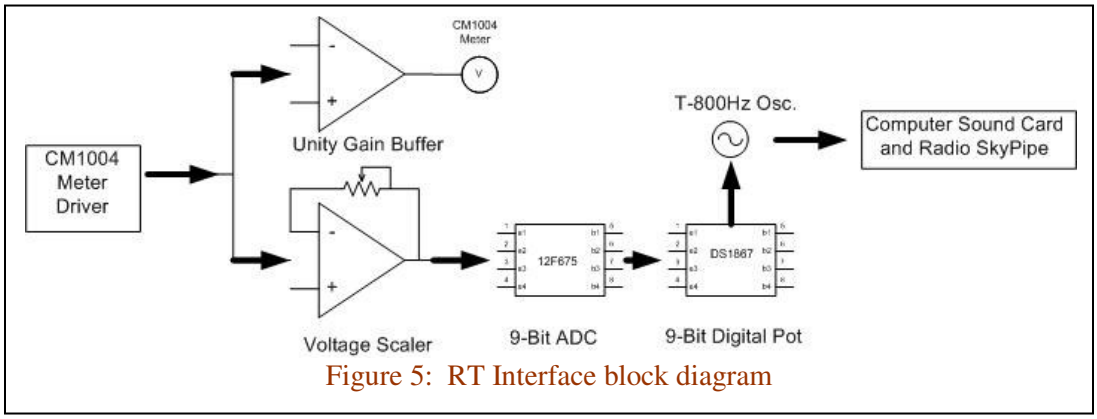


Figure 5: RT Interface block diagram

The unity-gain op-amp is a buffer between the CM meter driver circuit and the analog meter. The other op-amp is a voltage multiplier, which scales the CM meter-driver output voltage, matches the 5-volt reference voltage of the following analog-to-digital converter (ADC). The variable resistor in this voltage multiplier circuit is used to calibrate the CM to the Skypipe. The voltage from the multiplier feeds a programmable interface controller (PIC) programmed as a 9-bit ADC. It converts the analog voltage, which is a function of received signal strength, to a 9-bit digital word used to control a variable resistor. The interface includes a simple Twin-T Audio Oscillator circuit that provides an 800 MHz tone to the computer sound card. The amplitude of this audio oscillator is varied by the digital pot, which is controlled by the PIC. This results in an audio amplitude varied in step with the signal sensed by the CM.

The circuit provides power to the CM and the LNB. Twelve volts are tapped through an RF choke and this is connected to the LNB coax connector inside the CM. The 12-volts are also regulated to 5-volts powering the interface. Though probably not required, there should be two 5-volt sources: one for the digital components of the interface and the other for the analog components with one common ground point. This arrangement is

used to isolate potential digital and analog noise sources within the circuit. The interface is built on a circuit board and mounted inside the CM box. An etched circuit board is not necessary; a hand-wired prototype works equally well.

The PIC requires software, which is available on e-mail request (mspencer@arrl.org), or one can easily program their own PIC. The first thing one needs to learn is how to point the RT antenna. The best place to start is to connect the CM to the antenna and point it at the Sun. Adjust the azimuth and elevation until you get the peak signal strength indicated on the CM meter or the highest pitch audio tone. With the antenna pointed directly at the Sun, note of the position of the shadow of the LNB on the surface of the dish. From behind the dish, look along the LNB supporting arm (between the arm and the rim of the dish) and see the Sun being blocked by the LNB.

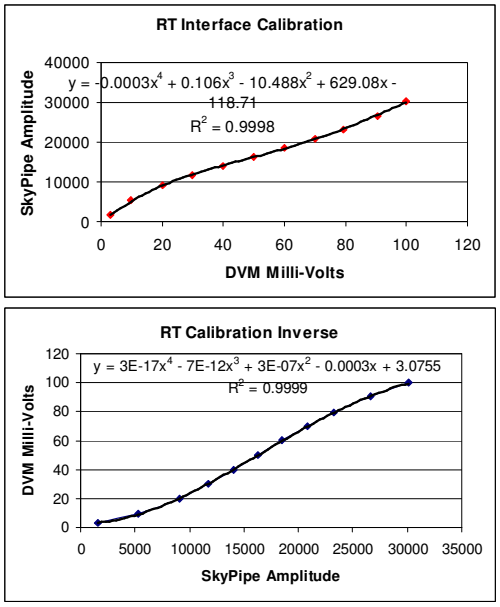


Figure 6: Example calibration curves

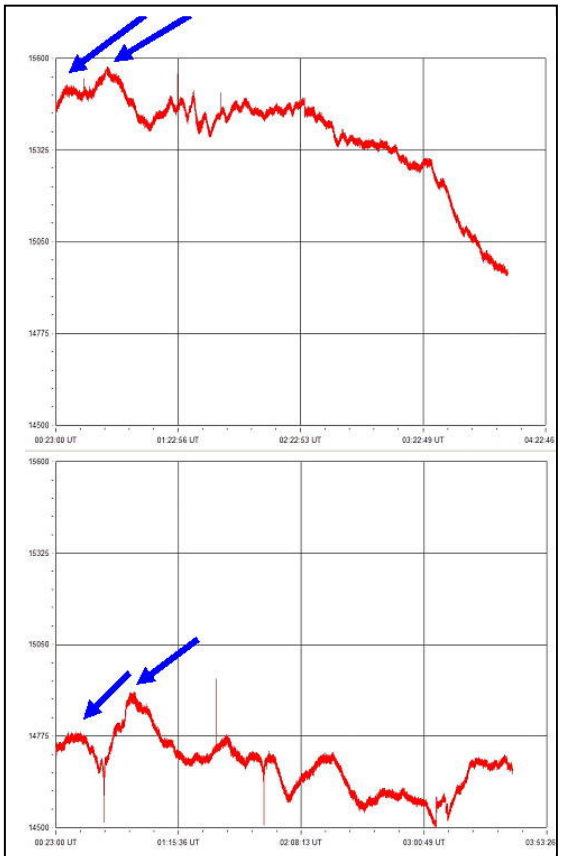


Figure 7: Sequential drift scans

Once the RT is set up, it needs to be calibrated to match the output of the CM to Skypipe. An Excel spreadsheet template to help with the calibration (as well as a few of the other activities one can accomplish with the RT) is available from the author via e-mail on request. Turn the RT to a signal source, such as the Sun or the side of a building acting as a thermal radiator. Turn the gain control of the CM to set the meter maximum. Run Skypipe and adjust the variable resistor on the interface board until one gets a approximate reading of 32,000 on the Skypipe graph (y-axis). With the maximum value set, adjust the CM gain control through the voltage range (0 to 100 mV) in 10 mV steps and record the corresponding y-axis value on Skypipe. This data is entered into an Excel spreadsheet to compute the

calibration curve between the actual voltage and the y-axis value. Both voltage and y-axis values are used in analyzing recorded signal strength data (figure 6).

After the calibration, a good activity is to do a drift scan of the Sun. A drift scan means that you set the antenna azimuth (AZ) and elevation (EL) while the Earth serves as the rotor and drags the antenna across the sky. To do a drift scan of the Sun, first set the elevation and azimuth to point directly at the Sun (maximum signal) and then move the azimuth toward the west (leave the elevation set) until you are off the peak signal. Then start Skypipe. In about 15 minutes, the Sun will pass through the antenna beamwidth and the result will be as illustrated in figure 7. In addition to beamwidth, one can also determine other antenna performance parameters.

Another activity is to do two drift scans of the night sky on two consecutive nights (beginning the scans at the same time each night and with the antenna pointing at the same AZ/EL). Comparing features, one will note a time difference is about 4.5 minutes on successive days. This shift is the result of the Earth's orbital travel in 24 hours. This illustrates that the Earth's rotation as well.

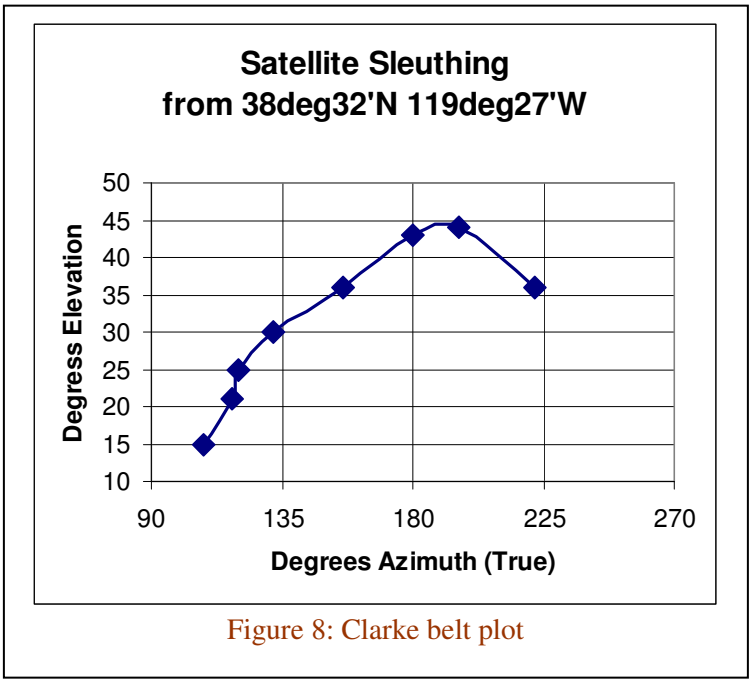


Figure 8: Clarke belt plot

Yet another good starting activity is to point the antenna toward the Clarke belt and find all the satellites in geosynchronous orbit transmitting 12 GHz. Record the peak signal and AZ/EL for each peak. Plot the position of Clarke belt satellites (figure 8).

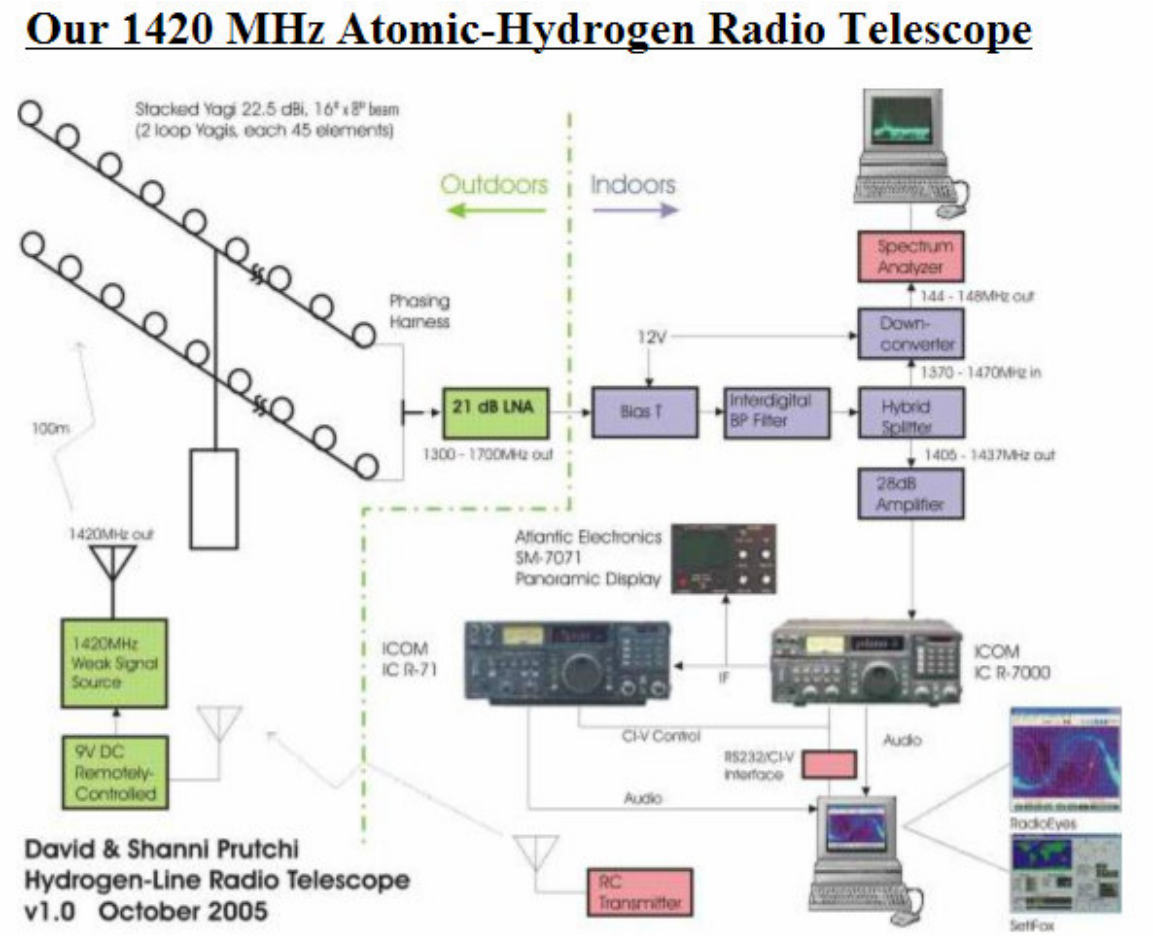
This only scratches the surface with what can be done when the "sky is the limit."

[1] http://www.setileague.org/articles/lbt.pdf
[2] http://www.aoc.nrao.edu/epo/teachers/ittybitty/procedure.html
[3] http://www.pctinternational.com/channelmaster/0612/satellite.html
[4] http://radiosky.com/skypipeishere.html
[5] http://en.wikipedia.org/wiki/Geostationary

~ Solar Radio Astronomy Miscellany: Stacked Yagis 1420 MHz Radio Telescope ~

By Shanni and David Prutchi

Editor's Note: Shanni presented a related talk at the 2005 SARA Conference. I encourage you to download the 10-slide PowerPoint in PDF format (see below) on the "1420 MHz Observation of the Solar Transit" using a non-dish radio telescope. One of the slides is reproduced below Though it may not be the most efficient system at this frequency, it demonstrates a great deal of resourcefulness.



http://home.comcast.net/~prutchi/index_files/astronomy.htm

http://home.comcast.net/~dprutchi/solar_transit.pdf

~ SARA-List Discussion on Loop Yagi Antennas ~

Prutchi's 2005 project with the stacked Yagi antenna had precipitated a recent discussion on loop Yagi antennas, which have been collated here.

From: Siddhartha Jain <siddhartha@siddharthajain.net>
To: Society of Amateur Radio Astronomers <sara-list@googlegroups.com>
Subject: [SARA] Loop Yagi antenna for 1420 MHz
Date: Apr 25, 2008 8:23 PM

Hi,

Hoping to do my first experiment with radio astronomy, I had this plan in mind.

First - The antenna

I did some research on the various antennas for 1420 MHz and given the limited space I have, I was wondering how well would a quad loop Yagi work? I saw this design in use here: http://home.comcast.net/~prutchi/index_files/astronomy.htm

So to save space, would it work if I used four five-wavelength boom-lengths in a 2 x 2 stack? Since no such loop Yagi antennas are commercially available, I was thinking of building them using:
- For boom, wooden dowel cut to the required boom length
- 14 loops, each of one wavelength perimeter and one reflector loop of a slightly larger perimeter using 12 AWG solid insulated copper wire
- Feed the driven loop element with RG59 coax directly

Connect the coax to a satellite dish signal strength meter, point the antenna (single, not the array) towards the Sun and see if the needle gets excited.

Does this sound like a reasonable experiment for a newbie?

Thanks,
Siddhartha

From: kl7uw <kl7uw@acsalaska.net>
To: Society of Amateur Radio Astronomers <sara-list@googlegroups.com>
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 26, 2008 11:13 AM

Siddhartha,

I can tell you a little about the use of Loop Yagi antennas since I am using two 45-element loop Yagi antennas at 1296 MHz for satellite ham radio use. These are manufactured by Directive Systems as a kit of loops and a small diameter boom that packs well for shipping by mail. http://www.directivesystems.com/

They make a 14-element loop Yagi (LY) so this will give you a reference to compare with. The 14-element LY exhibits a gain of 15 dB on a three-foot boom, so four of these would result in an array of 21 dBi gain. My 45-LY has a gain of 20 dB and array gain of 23 dBi. They are 12-foot long and stack about 16 inches apart.

Now compare this with a 3-meter (10-foot) dish, which is the standard antenna in use for either 1296 EME (moonbounce), or for 1420 radio astronomy. This antenna has a gain of 30 dBi (more than 4 times what my two and nearly ten times your proposed array). My point in telling you this is that your antenna array will be significantly less sensitive than the usual amateur radio astronomy antenna. How this will affect your ability to detect celestial objects is hard to say. You will be able to see the Sun and maybe the Moon.

You will need one more item to make this work. You need a good LNA for 1420 MHz. The satellite finder is a broadband detector and indicator, but you need low noise gain ahead of it, probably at least a 30 dB gain.

I do not know your financial situation, but one could make a decent antenna of four 45 or 55 element LY at 1300 MHz (26-27 dBi array gain) buying directly from Directive Systems. The antennas would cost $600 and a four-way combiner 33-4PD is $78. Or one could build a system at 1600 MHz with four 44-element Yagi antennas.

You could write them about making a custom antenna for 1420 MHz, but that may be expensive.

But using a ten foot dish would be easier and probably more effective if you can get one. In the USA they are often available free from home owners who have gone to using small KU-band TV dishes (if you offer to remove the dish for them).

As a side note: I have acquired a commercial 4.9m (16-foot) aluminum dish that was used for educational satellite TV in the Alaska School System when that was delivered on C-band. Now everything has gone to Ku-band. My dish cost me $200. I will have to make a feed, which probably will cost another $100 or more in materials, and a motorized mount, which will be $300 or more. I already have a 1420 LNA and 1420/144

and 144/28 MHz converters so that my 28 MHz SDR-IQ will be used at 190 KHz and for continuum observations.

I hope this helps you.
Ed Cole, SARA Board Member
http://www.kl7uw.com/raseti.htm

From: Brian <bkloppenborg@gmail.com>
To: Society of Amateur Radio Astronomers <sara-list@googlegroups.com>
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 26, 2008 11:33 AM

If you are interested in building the antenna from scratch, there are design instructions in the "VHF-UHF Manual" by Evans and Jessop (1977). They call this antenna a "quad-Yagi". They have all of the dimensions labeled in the book (in inches) for an antenna for 1.296 GHz. I setup an Excel spreadsheet to scale this antenna to an arbitrary frequency so I could build one for 2.4 GHz (802.11b networking). If you would like a copy, please let me know and I'll post it to my website.

Brian

From: Siddhartha Jain <siddhartha@siddharthajain.net>
To: sara-list@googlegroups.com
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 26, 2008 2:58 PM

Ed/Brian - Thanks for your informative posts. Ed's was especially useful from a newbie's perspective.

Costs aside (since most of my $$ are sunk in amateur radio gear), the issue I face is space since I live in a rented apartment. I think that says enough about my 3D constraints. I could've probably gotten away with a quad loop Yagi with each Yagi about 3 feet but as I understand from your posts and other material on the internet that will only be good for solar observations. Anything bigger will run into local zoning laws as I found out when I wanted to put up a vertical for HF.

Incidentally, I did find some designs for loop Yagi antennas in the ARRL antenna handbook and some construction notes on the internet too.

Brian - On 2.4 GHz antennas, I recently ordered a Yagi for the same purpose (connect to the Meraki wireless mesh network here in San Francisco). I found a seller on eBay who had these "*Enterasys Roamabout* 14 dBi Yagi Antenna". I ordered one and there are four

more left so unless you want the satisfaction of having built one yourself, this might be something worth looking at. They are $40 each including shipping.
http://cgi.ebay.com/Enterasys-RoamAbout-14dBi-Yagi-Antenna-WiFi-802-11_W0QQitemZ290224945267QQihZ019QQcategoryZ61816QQssPageNameZWDVWQQrdZ1QQcmdZViewItem

Back to radioastronomy, I was wondering if there is any volunteer work available for small projects? I was hoping that the SETI guys who work from the same office as I do, here in Mountain View, would have some kind of open house but they seem to have stopped the practice. I checked with the reception and the only volunteer work they were offering was help with sending out mailers (licking stamps and such).

I dabbled a little bit in meteor detection with a TV Yagi antenna at my previous location, Santa Clara. Santa Clara had some unused TV channels that could be used for meteor scatter detection. Here in San Francisco, all FM and TV channels are used, plus my proximity to Sutro Tower gives me a lot of IF harmonic distortion.

Thanks,
Siddhartha, WV6U

From: Rodney Howe <ahowe@frii.com>
To: sara-list@googlegroups.com
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 26, 2008 7:52 PM

Siddhartha, SARA

If tight on space and interested in looking at the sun this might be a place to start:
http://www.aoc.nrao.edu/epo/teachers/ittybitty/procedure.html

Has anyone tried to modify a C band TRVO LNB to match the 2800 MHz frequency of the 10.7 cm line? Perhaps a dab of solder on the feed element would make it ¼ wavelength, but would there need to be modifications to the LNB itself, and the waveguide (feed horn)? This would be a neat project, I think. Can these old feed horns be re-tuned to look at the 10.7 cm line for monitoring the Solar Index?
http://www.nwra-az.com/spawx/f10.html
http://en.wikipedia.org/wiki/Solar_cycle
For some history: Dominion Radio Astrophysical Observatory:
http://www.drao-ofr.hia-iha.nrc-cnrc.gc.ca/icarus/www/sol_home.shtml

Rodney

From: Brian <bkloppenborg@gmail.com>
To: Society of Amateur Radio Astronomers <sara-list@googlegroups.com>
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 27, 2008 11:50 AM

In case anyone is interested, I made up an Excel Spreadsheet to scale the design parameters I found in the "VHF-UHF Manual" (Evans, Jessop 1977 http://books.google.com/books?id=zTNUAAAACAAJ). I've posted the worksheet on my server here at home: http://projectdevel.homeip.net/files/quad-yagi/

Brian

From: kl7uw <kl7uw@acsalaska.net>
To: Society of Amateur Radio Astronomers <sara-list@googlegroups.com>
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 27, 2008 4:56 PM

These are very good responses from all to Siddhartha's WV6U questions. Considering your apartment constraints it will be a challenge to make a workable antenna for 1420 RA. Going up in frequency may be a partial solution. Could you handle a 1-meter dish (39-inch)? At 10.7 cm that would have quite a bit more gain (around 26-28 dBi) than loop Yagi antennas which are reaching marginal design limits at this frequency. I have an 85 cm dish (33-inch) that I use for 2.4 GHz satellite reception. I has a very good LNA (NF = 0.6 dB) and super gain of 41 dB. I would imagine it would work well with a satellite finder detector/meter. Sun measurements with narrowband receivers indicated about 5-6 dB of sun noise and about 3 dB of cold sky/warm earth differential. This was using a bandwidth of 2.2 KHz. You collect much more noise energy as the bandwidth increases. The Sat-Finder probably operates in several MHz of bandwidth. Noise increases proportional with bandwidth (dBm) => 20LogB (Hz), so an increase from 2.2 KHz to 2.2 MHz is 2200/2.2 = 100 power ratio or 20 dB!

The biggest challenge to making a 10.7 cm RT would then be converting a C-band sat-TV LNA or LNB from 3.7 to 2.8 GHz. If you have access to a microwave signal generator and signal analyzer that would help. A noise figure meter would also be helpful. Would the SETI group allow you access to such equipment?

Baring that then a 2.4 GHz LNA might be useful with a very good high pass RF filter to eliminate everything below 2.6 GHz. There seems to be more equipment available for communications/ham frequencies than RA. You need to avoid 2.4-2.6 GHz because this band is loaded with wireless internet signals that would interfere with RA.

Have you considered the 3 cm Itty Bitty Radiotelescope Project?
Regards, Ed

From: Siddhartha Jain <siddhartha@siddharthajain.net>
To: sara-list@googlegroups.com
Subject: [SARA] Re: Loop Yagi antenna for 1420 MHz
Date: Apr 27, 2008 5:27 PM

Indeed, the responses have been very informative. Thanks a lot, everyone!!

Yes, I think a 33"-39" dish should be ok. I was eyeing a 36" dish on Craig list that is going for cheap. But I am more interested in something beyond solar observations.

Q. I was reading more about going up on the frequency and came across all these papers, mostly very scientific, about 12 GHz methanol masers. Can someone please throw more light on this in a little bit watered down language :) The Saser project page only has some data collected from 2002. Also, several projects go further up in frequency: 36 GHz, 44 GHz, and even to 96 GHz. What does this mean for amateurs?

About getting any access to SETI's infrastructure, I am not sure. They haven't had an open house in the last year at least. Maybe I can ask one the employees when I run into them in the hallways of the building. I was hoping if any of them are on this list then maybe they could let me know about any volunteer work available for an intermediate computer / beginner amateur radio geek :)

Siddhartha

~ SETI League Press Release Honors Tom Crowley ~

From: "Prof. H. Paul Shuch" <n6tx@setileague.org>
To: undisclosed recipients
Subject: SETI League Press Release 08-05
Date: Apr 20, 2008 9:20 PM
SETI League Announces Annual Awards

Little Ferry NJ, 20 April 2008 -- At its Annual Meeting this afternoon at its New Jersey headquarters, the nonprofit SETI League, leaders in a global search for extra-terrestrial intelligence, recognized two individuals for major contributions to the art and science of SETI. Honored this year for their efforts and accomplishments were Dr. Ivan Almar of Hungary, and Tom Crowley of the United States.

The SETI League recognized Dr. Ivan Almar of the Konkoly Observatory, Budapest, with its annual Giordano Bruno Memorial Award, for technical excellence in the service of SETI. Almar is the originator of the San Marino Scale, an analytical tool for assessing the impact of transmissions from Earth. This scale was adopted in September, 2007 by the SETI Permanent Study Group of the International Academy of Astronautics (IAA), lending a quantitative basis to discussions of policy regarding Active SETI experiments. Previously, Dr. Almar had co-authored the Rio Scale, another analytical tool adopted by the IAA, used for quantifying the significance of extraterrestrial signals received on Earth. A Full Member of the IAA, Almar has been an active member of its SETI Committee since its inception more than three decades ago.

Tom Crowley, amateur radio callsign KT4XN, was selected to receive The SETI League's annual Orville Greene Service Award, for exemplary volunteer service to the nonprofit organization. A Charter Member of The SETI League, Crowley has long served as a SETI League volunteer Regional Coordinator. He has served as President and Treasurer of the Society of Amateur Radio Astronomers (SARA), a SETI League affiliate society, and participated in many SARA and SETI League meetings over the years. His efforts to bring the two organizations closer together have helped to legitimize SETI science as a respected branch of radio astronomy.

As neither award recipient was able to be present at today's meeting, formal award presentations will occur in the near future. SETI League executive director emeritus Prof. H. Paul Shuch plans to present Crowley with his plaque at the SARA Annual Meeting, to be held at the National Radio Astronomy Observatory, Green Bank WV, in late June. He will similarly honor Almar at the IAA's upcoming International Astronautical Congress in Glasgow, Scotland in September.

The Trustees of The SETI League also acted at the annual meeting to confirm two new appointees to the SETI League Advisory Board. Joining five other distinguished scientists and technologists are science fiction author and longtime SETI League member

Greg Bear, whose late father-in-law Poul Anderson previously served on the Advisory Board, and Prof. Paul Davies, a physicist, author, and science popularizer, who fills a vacancy left by the recent passing of senior SETI League advisor Sir Arthur C. Clarke.

Also at the Annual Meeting, a moment of silence was observed, in remembrance of Clarke and Marc Arnold, Esq., a trustee since the organization's inception, who passed away last week. SETI League president Richard Factor was appointed to replace Arnold as Registered Agent.

In other actions at today's meeting, the Board of Trustees accepted the Executive Director's and Secretary/Treasurer's annual reports; adopted a 2008 budget; re-elected its officers (Richard Factor, WA2IKL, President; A. Heather Wood, Secretary/Treasurer; H. Paul Shuch, N6TX, Executive Director Emeritus) to serve on a volunteer basis for an additional one-year term; approved an extension of new SETI League memberships dues for members in good standing of affiliate society SARA, the Society of Amateur Radio Astronomers; and agreed to continue cost sharing of the Executive Director Emeritus' health insurance premiums.

Largely using radio telescopes and optical telescopes, SETI scientists seek to determine whether humankind is alone in the universe. Since Congress terminated NASA's SETI funding in 1993, The SETI League and other scientific groups have privatized the research. Amateur and professional scientists interested in participating in the search for intelligent alien life, and citizens wishing to help support it, should email join@setileague.org, check the SETI League Web site at http://www.setileague.org/, send a fax to +1 (201) 641-1771, or contact The SETI League, Inc. membership hotline at +1 (800) TAU-SETI. Be sure to provide us with a postal address to which we will mail further information. The SETI League, Inc. is a membership-supported, non-profit [501(c)(3)], educational and scientific corporation dedicated to the scientific Search for Extra-Terrestrial Intelligence.

P.S. Tearsheets are always appreciated. Thank you.

-end-

H. Paul Shuch, Ph.D.
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"We Know We're Not Alone!"

~ SETI League Offers SARA ~

SETI League offers SARA members free book, free six months

At its Annual Meeting in April 2008, the Board of Trustees of The SETI League, Inc. voted to extend a special membership offer to members of our sister organization, the Society of Amateur Radio Astronomers. All SARA members joining The SETI League at the 2008 SARA Conference will receive an extra half-year of SETI League membership at no additional cost. That is, one year of dues will buy you SETI League membership from the SARA Conference dates through 31 December 2009. In addition, while supplies last, each SARA member joining or renewing a SETI League membership at Green Bank will receive a FREE copy of *Project Cyclops*, the historic NASA radio telescope design study from 1971. The SETI League is also continuing to encourage its members to join SARA, and participate in its activities (including the annual Green Bank Conference).

Dr. H. Paul Shuch, N6TX
Vice President and Webmaster, Society of Amateur Radio Astronomers
email vicepres@radio-astronomy.org http://radio-astronomy.org

~ Experiments for SARA at Green Bank ~

By John C. Mannone

In the final preparation for your trip to the Conference, please do give some thought to the opportunities we have for some interesting experiments.

I had asked Sue Ann Heatherly for the excellent radio astronomy exercises on the 40-foot where we would be tasked to determine an "unknown" radio target given sufficient, but minimal information. I had seen these at the Chautauqua Conference in the past. Unfortunately, I did not receive them in time before publication, but they might be available for us when we get there.

In the 2007 pre-conference issue of the Journal, some experiments with the 40-foot were suggested. And in the 2007 post-conference issue, some results and suggestions for the following year were posted. It is worthwhile to review both issues for ideas.

One of the things I hope to do is to generate a three-dimensional plot of another portion of the Milky Way. Last summer I plotted a portion Sagittarius, this year I would like to attempt Cygnus-A. Perhaps some of you would like to join in. The downside is that it will not be in the beam until 2:30 am and data acquisition is for at least one hour.

In another experiment, I hope to attach the Jansky antenna. A few dedicated SARA members enabled a feed to the Drake Lounge a couple of years ago. The 20.5 MHz Bruce array has a cooperative VSW to accommodate the 20.1 MHz Radio Jove receiver or possibly another receiver. (A typical SWR plot would show a 2:1 SWR bandwidth greater than 400 kHz.) I think it is worth a try. If we get lucky, the sun will be flaring.

I am sure there are more ideas. please contact me (and/or the Board) with any questions, preferences, or suggestions. Your feedback is important.

Have fun in your musings and see you at Green Bank.

~ Radio Astronomy Resources ~

SARA
http://radio-astronomy.org

Radio Astronomy Supplies
(Jeffrey M. Lichtman)
P.O. Box 450546
Sunrise, FL 33345-0546
(954) 965-4471 / jmlras@mindspring.com
http://www.radioastronomysupplies.com

Radio Sky Publishing
(Jim Sky)
PMB 242, Box 7063
Ocean View, HI 96737
(808) 328-1114
http://www.radiosky.com

National Radio Astronomy Observatory
http://www.nrao.edu

Tamke-Allan Observatory
(David Fields)
http://www.roanestate.edu/obs

Jamesburg Earth Station volunteer group
http://www.jamesburgdish.org
http://www.bambi.net/jamesburg.html

RF Associates
(Richard Flagg)
1721-I Young Street
Honolulu, HI 96826
(808) 947-2546

SETI League
http://www.setileague.org

European Radio Astronomy Club
http://www.eracnet.org/

Pisgah Astronomical Research Institute
http://www.pari.edu

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Address Service Requested
April/May 2008