The AMSAT® Journal

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Volume 38, Number 2 **March/April 2015**

✓ Fox-1A Testing: Complete
✓ Mission Readiness Review: Complete
✓ Integration into P-POD: Complete

Run FUNcube Dongle PRO with a Tablet

in this issue ....

Periodicals
POSTAGE PAID
At Kensington, MD
and at additional
mailing offices

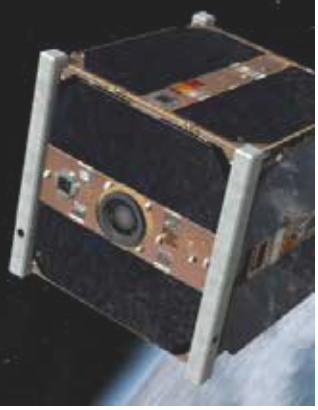
AMSAT-NA
10605 Concord St., Suite 304
Kensington, MD 20895-2526

Commit to the Future of AMSAT

- **AMSAT has committed to launching Fox-1C in 3Q 2015.**
- **We teamed with SpaceFlight, Inc. for integration and launch utilizing SpaceFlight's SHERPA System to sun-synchronous orbit in third quarter of 2015 and we have already paid the launch fee.**
- **AMSAT must now raise the funds to recover those funds to re-establish our reserves.**
- **Along with serving as a "rainy day fund", these reserves provide the "seed money" for future satellite projects.**
- **It takes real dollars to develop real satellites.**
- **As a result, AMSAT has initiated a $125,000.00 campaign to raise the capital needed to provide the resources to maintain our ability to initiate future projects.**

Please consider these donation options

- **Donate to the AMSAT President's Club**
- **Cash gifts with your credit card, PayPal, or check**
- **Gift of life insurance by naming AMSAT as a beneficiary**
- **Gift of stocks or other securities**
- **Bequest to AMSAT in your will or trust**
- **AMSAT is a 501(C)(3) non-profit organization**
- **Call the AMSAT-NA office at 301-822-4376 for questions on any or all of these ways to keep Amateur Radio in space.**



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AMSAT Announcements

2015 AMSAT-NA Board of Directors Nominations Notice

It is time to submit nominations for the upcoming AMSAT-NA Board of Directors election. Four director's terms expire this year: Barry Baines, WD4ASW; Alan Biddle, WA4SCA; Mark Hammond, N8MH; and Jerry Buxton, N0JY. In addition, up to two Alternates may be elected for one year terms.

A valid nomination requires either one Member Society or five current individual members in good standing to nominate an AMSAT-NA member for Director. Written nominations, consisting of the nominee's name and call, and the nominating individual's names, calls and individual signatures should be mailed to:

AMSAT-NA
10605 Concord St, #304
Kensington, MD 20895-2526.

In addition to traditional submissions of written nominations, which is the preferred method, the intent to nominate someone may be made by electronic means. These include e-mail, fax, or electronic image of a petition. Electronic petitions should be sent to MARTHA@AMSAT.ORG or faxed to (301) 822-4371.

No matter what means is used, petitions MUST arrive no later than June 15th at the AMSAT-NA office. If the nomination is a traditional written nomination, no other action is required. If it is other than this, i.e. electronic, a verifying traditional written petition MUST be received at the AMSAT-NA office at the above address within 7 days following the close of nominations on June 15th.

ELECTRONIC SUBMISSIONS WITHOUT THIS SECOND, WRITTEN VERIFICATION ARE NOT VALID UNDER THE EXISTING AMSAT-NA BYLAWS.

AMSAT's Mission

AMSAT is a non-profit volunteer organization which designs, builds and operates experimental satellites and promotes space education. We work in partnership with government, industry, educational institutions and fellow Amateur Radio societies. We encourage technical and scientific innovation, and promote the training and development of skilled satellite and ground system designers and operators.

AMSAT's Vision

Our Vision is to deploy satellite systems with the goal of providing wide-area and continuous coverage. AMSAT will continue active participation in human space missions and support a stream of LEO satellites developed in cooperation with the educational community and other amateur satellite groups.

Radio Amateur Satellite Corporation (AMSAT-NA)
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AMSAT-NA Board of Directors

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Vice-President Human Spaceflight: Frank Bauer, KA3HDO
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Editorial Office: JoAnne Maenpaa K9JKM, 608 Hawthorne Lane, Carpentersville, IL 60110. Please e-mail Journal submissions to: *journal@amsat.org*, Editor's telephone: 847-239-2286 (cell). Advertising Office: AMSAT-NA Headquarters, 10605 Concord St., Suite 304, Kensington, MD 20895-2526, Telephone: 301-822-4376.

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Postmaster: Send address changes to *The AMSAT Journal*, 10605 Concord St., Suite 304, Kensington, MD 20895-2526.

The AMSAT Journal staff is always interested in article submissions. Whenever possible, submissions should be sent via e-mail to journal@amsat.org using plain text or word processor files; photos or figures in TIF, GIF or JPEG formats. Kindly do not embed graphics or photos in your manuscript - we prefer receiving those as separate files. AMSAT-NA reserves the right to select material for *The AMSAT Journal* based on suitability of content and space considerations. The editors of this publication are volunteers giving freely of their talents, time and efforts to produce *The AMSAT Journal*.

As I write this during the week of March 22, 2015, we're still waiting for spring to be sprung in the Northeast. The Grapefruit League (Florida) and the Cactus League (Arizona) may be preparing teams for the 2015 MLB season, but we're still seeing snow, ice and very cold temperatures in the Northeast, raising the question of whether winter weather will still be with us for some time. Indeed, it snowed on the first day of spring in Boston as Beantown set a new annual snow total!

That said, there are indeed "Signs of spring" that I pay attention to that provide some indication that a new season is upon us….

Delivery of the Fox-1A CubeSat

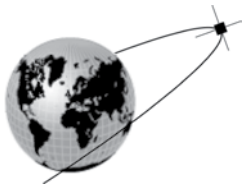
VP-Engineering Jerry Buxton N0JY, is hand carrying our newest spacecraft to Cal Poly in San Luis Obispo, CA for integration this week (March 24, 2015) This week marks the last time that our AMSAT Engineering Team has their hands on their latest creation. Given that the AMSAT Board of Directors approved the proposal by AMSAT VP-Engineering Tony Monteiro, AA2TX (SK) in October 2009 that the most effective mechanism to get AMSAT back into space was to utilize the CubeSat space frame, it is certainly satisfying to see that vision become a reality.

Congratulations to our Engineering Team (which was essentially "rebuilt" in 2009) for completing Fox-1A, opening the doorway for keeping amateur radio in space. Integration of our satellite into the "P-Pod" will be done while Jerry is at Cal Poly. Once that is done, we await launch that is currently scheduled to take place in late August from Vandenberg AFB, CA. This is truly a significant milestone for AMSAT, and we look forward to a successful deployment once the launch vehicle delivers Fox-1A into orbit.

Fox-1C Moves Forward

With the delivery of Fox-1A, our engineering team's focus moves to Fox-1C. AMSAT has signed a contract with Spaceflight, Inc. to launch our satellite using their "Sherpa" deployment system. The mission will be flown on a Falcon-9 launch vehicle from SpaceX later this year. See the "Engineering Update" article in this issue of *The AMSAT Journal* for details about our Fox-1C and other associated CubeSats.

AMSAT Satellite Design



AMSAT VP-Engineering Jerry Buxton, N0JY announced the "Design AMSAT's Next Satellite" program at the 2014 AMSAT Space Symposium. As AMSAT winds down from Fox-1 program development, the question becomes "What does AMSAT do next?" The purpose of the "Design AMSAT's Next Satellite" is to encourage individuals or teams to put forth proposals of how and why AMSAT should invest its time, talent, and treasure into a new satellite program. The intent is to provide opportunities for input as the AMSAT leadership considers various potential options for future projects. Details may be found on the AMSAT website. Submissions must be made by May 31, 2015, with review of ideas taking place over the summer and into fall.

Response to this process has been positive, suggesting that some serious consideration is being made of what AMSAT's future direction in space should be. Meanwhile, we are becoming aware of some interesting possibilities that are being brought to our attention by other entities. While it is too early to note any details, it is safe to say that we're facing more possibilities today to fly future missions than we have seen in some time. In the end, it may turn out that what appears promising may turn out to be more speculation than fact, but we are encouraged by the perspective that the future appears to have more possibilities for "keeping amateur radio in space", which may not limit us to only ELaNa flight opportunities.

Dayton Hamvention

Certainly one of the highlights of spring is the Hamvention which takes place the weekend of May 18, 2015. Along with seeing a great number of people at Dayton, I always enjoy the opportunity to see the latest gear, talk about AMSAT, and do some "shopping" to enhance my ham station. Dayton is certainly unlike any other amateur radio gathering in North America.

The AMSAT website has details about our activities this year, which closely follows what we've done in prior years. Booth setup takes place on Thursday, the informal AMSAT social gathering is on Thursday evening and the hamfest begins on Friday morning. The AMSAT/TAPR Dinner takes place Friday evening at the same venue

continued on page 4...

Apogee View - continued from page 3 ...

(Kohler Presidential Center). The AMSAT Forum is scheduled for Saturday with presentations on AMSAT Engineering, ARISS, Education, and Satellite Operations (including future satellites that are planned for launch in the next year), and AMSAT's new "Skunk Works" for developing new technologies.

Steve Belter, N9IP is serving as our team leader for our Dayton Booth activities. Our booth is located at the same spot as in 2014 in Ball Arena.

We expect to have new and updated items available at Dayton, so please stop by, say hello, and check out the items being offered. We're also looking for volunteers to help staff the booth; please contact Steve if you're interested in helping out:

n9ip at amsat.org

While many of us are enduring through a long winter season, there are indeed reasons to look forward to spring.

AMSAT Nets

I've been an active amateur since 1977, and along with my significant interest in satellites I've also have been interested in more "traditional" amateur communications. Recently, I've also become interested in DMR (Digital Mobile Radio). The April 2015 issue of *QST* includes an article starting on page 30 which notes the various digital protocols being used in the amateur bands at VHF and above, including DMR. Given my constant travels between New England and Southeast Georgia, I've enjoyed using the DMR repeaters that exist in New England, New York State, Virginia and the Carolinas. DMR has rekindled my interest in working VHF/UHF repeaters again as I travel. I've had some great conversations with AMSAT members on the NCPRN network as I'm traveling down I-95 in the Eastern Carolinas, as well as in in Western North Carolina or Virginia.

Another rekindling of interest I've enjoyed recently is participating when I can on the weekly AMSAT 20 Meter Net that takes place at 1900 UTC on Sundays on 14.282 MHz. Keith Pugh, W5IU and Larry Brown, W7LB serve as net control stations. The net has evolved recently to where people interested in satellites can check-in and ask questions, exchange notes, etc. Details on the 20 Meter Net can be found in this issue of the *AMSAT Journal*.

While I've spent many hours getting my basic station operational in Georgia, the challenge has been to develop my HF station for remote capability so that I can operate it from Westborough, MA. After some fits and starts dealing with some technical issues, I'm now able to utilize my station in Folkston from my primary residence in Westborough. I look forward to getting on the AMSAT net more often as my schedule, internet connection quality, and band conditions allow. If you haven't checked out the AMSAT Net recently, I encourage you to "check-in" on the net in the near future.

Keith, W5IU is also interested in knowing about local AMSAT Nets that may be taking place around the country on repeaters or other venues. If you're involved with any AMSAT net activity, please alert Keith (w5iu at amsat.org) to AMSAT-related net activity.

BOD Election

Spring is also the time for individuals interested in running for the Board of Directors to get their nomination forms signed and submitted to the AMSAT office. The deadline for filing is June 15, 2015. A nomination form with signatures from five current AMSAT members is required; club memberships can nominate as well. Details on nominating someone can be found in this issue.

One of the privileges of AMSAT membership is the right to nominate people for service on the AMSAT Board (two year term for voting members; board alternates are designated until the next election) as well as to vote on the candidates once the ballot is received. Please take time to participate in this process as the future of AMSAT is dependent in part upon the quality and enthusiasm of the candidates as well as the time taken by members to vote on those candidates.

James Lea, WX4TV caught a video of his daughter Hope, KM4IPF, as she made her first contact as a licensed amateur radio operator. Her call sign appeared in the FCC database about 30-45 minutes before the FO-29 pass on March 11 at 2100 UTC. Her older brother (WX4TVJ) and sister (WA4BBC) got to work K4YYL as well. Zechariah made another contact in Virginia and Faith Hannah attempted a VE3 station as the satellite was passing behind the home next door. Fun was had by all! Not too many 8 year old girls get to make their first QSO on OSCAR! Thanks to W4BUE and the K4AMG Memorial Amateur Radio Club for the opportunity! Watch the video at:

https://vimeo.com/122112807

On a recent trip to see relatives in Florida, Glenn Miller (AA5PK, right) stopped off in Lake Charles, LA and enjoyed some of the local southwest LA cuisine and hospitality. Welcoming him were George Carr (WA5KBH, left) and Jack Wilson (KF5LOQ, center).

Amateur Satellites at Anchorage Engineer's Week

Craig Bledsoe. KL4E
kl4e@amsat.org

I recently had the opportunity to provide amateur satellite demonstrations during the 2015 Anchorage Engineers Week educational activities. Overall, the presentations included 17 schools and one youth group with 24 speakers and 1,084 students in Anchorage, Alaska.

On February 24, my three satellite demonstrations via SO-50 attracted an estimated 150 students at Wonder Park Elementary School in Anchorage. When I set up the Arrow antenna, I was like the Pied Piper - kids came from everywhere! Also multiple class attendances for each of the three presentations excited 150 future professional engineers and ham radio operators.

My sincere thanks to Dale Hershberger, KL7XJ; Bob Engberg, KL5E; and Takeshi Morgan, KL3IT, for being on the other end of these important satellite passes and talking to all the eager participants.

(Photos, right) Craig, KL4E at Wonder Park Elementary School, Anchorage, Alaska.

Represent AMSAT in Your Area AMSAT Field Operations Opportunities

AMSAT's Field Operations Team is looking for satellite operators to promote amateur radio in space with hands-on demonstrations and presentations.

- Promote AMSAT at hamfests
- Setup and operate satellite demonstrations at hamfests
- Provide presentations at club meetings
- Show amateur radio in space at Dayton, Pacificon, Orlando Hamcation

To volunteer send an e-mail to Patrick Stoddard, WD9EWK at: wd9ewk@amsat.org.

Pairing SDR dongles with smaller Windows 8.1 tablets

Patrick Stoddard WD9EWK/VA7EWK
wd9ewk@amsat.org

Like many satellite operators, I occasionally work satellites using a FUNcube Dongle Pro+ USB dongle with HDSDR software. Although I enjoy being able to see the entire transponder on my screen, one problem for me has been that the laptop screen is hard to see in bright light in the field, requiring me to find a larger flat surface to accommodate the laptop along with my FT-817ND.

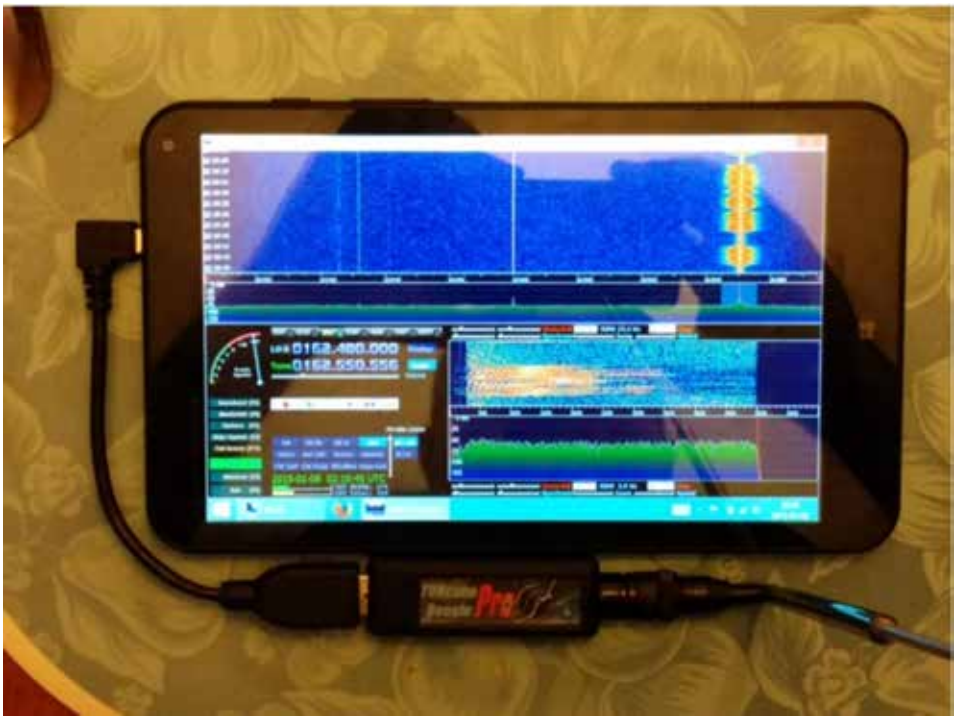
In late 2014, I solved the problem with a smaller (7- and 8-inch) Windows 8.1 tablet. Unlike many other tablets, these were effectively "real" computers, and affordably priced anywhere from $50 to $200. The smaller Windows 8.1 tablets are available from many different manufacturers and vendors. They share some common features:

1. Limited memory (1 GB to 2 GB RAM);
2. Limited internal storage, for the C: drive (16 GB to 32 GB);
3. Limited capacity of micro SD card slot, for the D: drive (16 GB, 32 GB, or sometimes 64 GB);
4. 2.4 GHz WiFi, and sometimes a 3G or 4G data modem;
5. A 64-bit quad-core Intel CPU, but with a 32-bit version of Windows 8.1; and
6. Some tablets have a single micro USB socket, while others have more USB ports and/or a micro HDMI port.

These tablets are like the netbooks of a few years ago, but with more limited capabilities. They are not intended to be replacements for larger tablets or laptops. Even so, I successfully have used an 8-inch HP Stream 8 tablet with my FUNcube Dongle Pro+ and the same software I run on my laptop for satellite operating. The advantage is that the SDR side of my satellite station is much more portable than with the laptop.

For many of these tablets with a single micro USB socket, a "USB On-The-Go" cable is required. The On-The-Go cable provides a standard USB socket, which can be used with any USB device like keyboards, mice, memory sticks, hard drives, and SDR dongles. These cables are inexpensive, usually priced around $4 to $5 each. Tablets with more USB sockets may not need the On-The-Go cable.

The tablet I bought was intended for use with Microsoft's "cloud" (Internet-based) services. This may be fine for some, but I wanted to make the functionality as similar to my laptop as possible. I reconfigured the tablet so it would not require a Microsoft account to use, uninstalled some of those programs, and then proceeded to install the software I wanted. I purchased a 32 GB micro SD card, which stays in the tablet as the D: drive. I reconfigured some of the Windows folders like Documents, Downloads, etc., to use the D: drive instead of the C: drive.



Tablet with HDSDR and FUNcube Dongle ProPlus

I used the desktop mode of Windows 8.1 for installing programs like HDSDR (including the ExtIO DLL to support the FUNcube Dongle Pro+). This is similar to, but not exactly like, the desktop mode of Windows 7 and earlier versions. A "Classic Shell" program for Windows 8 systems provides a desktop similar to Windows 7, but I have not needed to install it on my tablet. The desktop mode in Windows 8.1 has been adequate for my needs.

A Bluetooth mouse has proven helpful when using HDSDR. The mouse wheel serves as a VFO knob, and sometimes the mouse is easier to use than pressing the tablet's screen for some functionality. If I set up HDSDR with the parameters I want for the satellite I'm working, I can use it without the mouse in the field. Most of the time while working satellites, I just use the Bluetooth mouse with the tablet.

How well does the 8-inch tablet work with the FUNcube Dongle Pro+? I have had my tablet for a month and used it on many passes of AO-7, AO-73, FO-29, and SO-50. The tablet can handle the dongle and HDSDR comfortably. For the transponder satellites, it is nice to see all of the transponder, making it easy to find the activity during a pass. For SO-50, HDSDR's Automatic Frequency Control (AFC) function works for most of the pass, adjusting the receive frequency to compensate for Doppler without having to touch the mouse or tablet. The waterfall clearly shows the Doppler effect on the downlink signals, especially with SO-50's downlink.

The audio jack on the tablet is a standard 3.5mm (1/8") socket. Although I could rely on HDSDR to record the audio I hear, along with the passband visible in the program, I still use a separate audio recorder for logging. I plug a Belkin Rockstar 5-way splitter into the audio jack, and connect my recorder with either earbuds or the earpiece from my Heil Traveler headset/mic into the splitter. The tablet has more than enough audio to drive both devices.

I use the Elk Antenna's handheld 2m/70cm

log periodic. This antenna, with its single coax feedpoint, requires a diplexer if I use separate radios for transmit and receive. The diplexer also acts as a filter when working modes J or V/U, and I have never detected any issues with the dongle and tablet when transmitting from either an FT-817ND at 5 watts or an FT-897D at 5 to 15 watts.

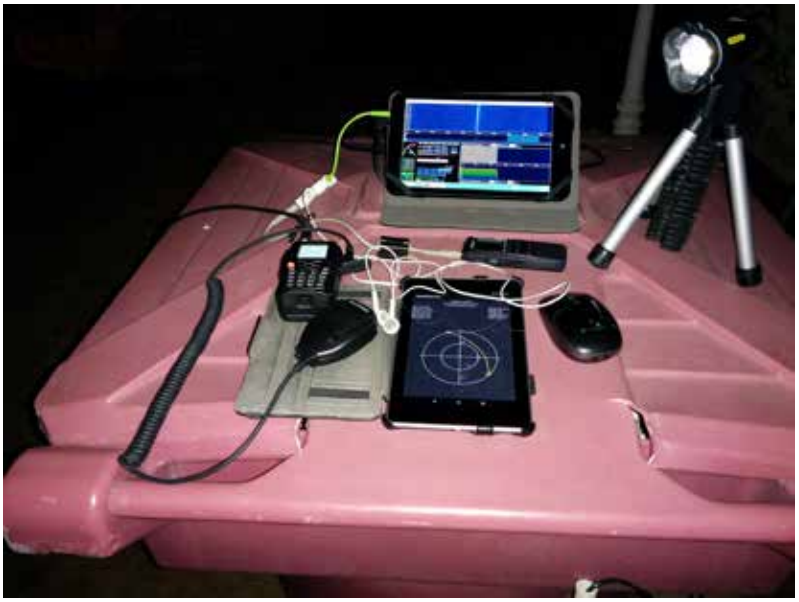
I sometimes still use a radio instead of a dongle when working satellites. For lower passes, the radio's receiver can be a little more sensitive than the dongle. If I am out in bright light, the displays on the radios are easier to see than the screen on the tablet. For most passes, however, I am now looking to use the tablet and dongle as my receiver for working FM or SSB/CW.

I have tried the SDR Sharp software on my tablet. It runs well, but I prefer HDSDR for working satellites. It puts everything I want into a single window and is easier to control in the middle of a satellite pass. Other software related to satellite operating, like SatPC32 and the FUNcube Dashboard, run fine on the tablet.

I have also used the cheaper (around $10 to $30) R820T "RTL-SDR" USB dongles with the tablet. Other than having to load the driver to support this dongle, it also works well. For satellite operating, I prefer the FUNcube Dongle Pro+ and its front-end filtering for 2m and 70cm. For other receive-only uses, the 3 MHz bandwidth from the "RTL-SDR" dongles – compared to 192 kHz from the FUNcube Dongle Pro+ - comes in handy.

The FUNcube Dongle Pro+ makes a good alternative to using a satellite-ready transceiver – or two all-mode transceivers – for working SSB/CW and FM satellites. These smaller Windows 8.1 tablets, coupled with the dongles, make this a lot less expensive than in the past. And these tablets perform like their larger, laptop or desktop cousins.

Tablet running HDSDR on an AO-73 pass.



Wouxun KGUV8D with tablet and dongle for SO50.

(photo right): Patrick's dog "Valley", HØUND, a retired greyhound racer, guards the portable station while waiting for a satellite pass.

The Gizmo Revisited

Art Payne, VE3GNF
adpayne@sympatico.ca

In the November / December, 2013 issue of the Journal I wrote about the Gizmo… a simple, azimuth-elevation (sometimes called az-el) mount for use with the popular Arrow style of antenna. I used this mount in attic of my garage during the months of February and March of 2014 with great success. I was able to work through all five satellites that were available at the time and make over 100 contacts with other satellite operators in 60 grids and 8 countries on 3 different continents with this easy to use mount. But, like all ham-radio related projects, one is prone to tinkering and I found that this was the case with the Gizmo. The updated Gizmo is shown in Figure 1 with the antenna, radio, tripod and counterweight.

Figure 1. Earth station shows fully operational earth station with radio mounted on bracket and attached to motorized Gizmo with control box

Soon after the original article was published, several hams asked my advice on how to both make and use this simple system.

One of the most frequently asked questions was about the bushings that I used for the unit. Since that time, I've put a little more thought into how those bushings could be made cheaper and easier. The best I could come up with was to take a PVC tee and a piece of 1/2 inch PVC tubing bored out with a 17/32 drill (or a ream, if you have one) and using a PVC tee). You can then make the main part quite cheaply. You only need to make the nipple that mounts on the tripod from 1/2 inch aluminum rod to be good to go. My original bushing is shown in Figure 2; my improved bushing is shown in Figure 3.

(left) Figure 2. Original Gizmo with bronze bushings

(below) Figure 3. PVC Gizmo with PVC bushings and tee

I was also asked frequently about the Gizmos's counterweight, which I made from a soup can filled with cement. I've since found that a short piece of 3/4 in PVC tube and a piece of 3 inch PVC tube with end caps filled with your favorite weight (sand, bird shot, BBs) would also work well. You just drill a hole in the caps to run the 3/4 inch PVC tube through glue cap on the 3 inch piece of PVC. Glue the 3/4 inch piece to the cap. Fill with weight and then slide the other cap over the protruding piece of 3/4 inch PVC tube. Score the 3/4 inch piece so it will compress onto the main shaft with a hose clamp. See Figure 4 for a close-up photo of the counterweight.

But all this did not overcome the one problem that occurred when I was using the Gizmo to track the birds: moving the antenna while transmitting. With a little thought, and some research on what was readily available, I came up with a simple motor drive that worked well on Field Day for the VE3SAR

Figure 4. Radio and counterweight mounted on main shaft before assembling and mounting on tripod

Figure 5. Motorized Gizmo showing worm gear 12 volt motor and 8 mm pillow block for extra support

Figure 6. Motorized Gizmo control box

group allowing us to work both FO-29 and the ISS.

The motor I used was a 0.06 rpm 12 volt worm gear motor available on ebay for about $14. I mounted it on a 1/4 inch aluminum plate base 2 inches by 4 inches and attached it to a 3/32 inch thick brass plate of the same size with stand-offs using longer stand offs to mount that plate to the base. I bored a 5/8 inch hole in the upper plate so that the Gizmo tee could pass through to the 6 mm shaft of the motor. Then, instead of having the Gizmo freely rotate, I used a piece of 5/8 inch brass machined to 3/8 inch and bored out to 6 mm. The 5/8 inch brass was about 1-1/2 inches long and machined to 3/8 inch diameter to about 3/4 of an inch. I then soldered the 5/8 inch brass rod into the copper tee of the Gizmo. I drilled the 3/8 inch length shaft so that I could put a set screw in it, tapping and threading it to accommodate the 6-32 screw that I chose. Refer to Figure 5.

Next, I made a control box using a double-pole, double-throw, "center off" switch and a momentary press button switch. I added a few Anderson power pole connectors and a length of speaker wire which allowed me to remote the Gizmo and antenna but still control the rotator from my operating position as needed. My control box is shown in Figure 6.

As I have said, this method worked well but I was already thinking about improvements. First of all, the original design placed a lot of torque on the motor shaft. So, to relieve some of the torque-induced stress, I made a modification, which we'll call "Gizmo Motor 1.1".

In the photos, note the 8 mm pillow block that I added to the original Gizmo mount. Unfortunately, this addition resulted in an interesting problem. When I gave the motor to my beta tester (Keith VA3KSF) to test on a tripod mounting, he soon found that the weight of the antenna stripped the set screw as I had to reduce the 3/8 in shaft to 8 mm. That, in turn, only left 1 mm of wall, which was simply not enough to hold the tapped set screw and, as a result, stripped it.

So, next, I contemplated using a 10 mm pillow block. But that was somewhat larger than what I wanted use. So, as a solution, I used a piece of 1/4 in brass rod, turned it on my lathe down to 6 mm (placing the shaft in a drill and applying a file would work just as

well. You are only removing a small amount of metal, 1/4 in is about 6.34 mm.) Next, I used a Dremel tool and ground off enough of the rod to match the size of the motor shaft. I then soldered the piece into the end of the 6 mm shaft, ran this through the pillow block, and tightened the set screws on the pillow block. Then, I slid this sub-assembly over the motor shaft and mounted the pillow block on the upper plate. I have since found that this modification of the "Gizmo Motor 1.1" assembly works quite well.

I have an idea on how to make a motor that will give directional information. I plan to call this modification "Gizmo motor 2.0", but that will be for another time and another article.

It is also my plan to be at this year's Dayton Hamvention® AMSAT booth to demonstrate how to build a simple Earth station using equally simple hand tools. In my hands-on effort, I plan to demonstrate how to manufacture an Arrow style antenna and build a Gizmo. Possibly, I may assemble a "Gizmo Motor 1.2" rotor along with a bracket to hold a hand-held radio and diplexer as shown in Figures 7 and 8.

I'm looking forward to seeing you all there… and on the birds!

Figure 7. Simple bracket made from 0.025 aluminum sheet bent in a vise

Figure 8. Radio bracket with Gizmo type of attachment to put it on counterweight shaft.

AMSAT at the Dayton Hamvention -- First call for volunteers

Last year, we had 52 people assist with the AMSAT booth at the Dayton. It was the efforts of those volunteers that made the 2014 Dayton Hamvention a success for AMSAT.

The interaction with AMSAT members, satellite operators, designers, and builders makes the whole experience a lot of fun.

The 2015 Hamvention is May 15-17. Would you consider helping AMSAT at Dayton this year?

Whether you're available for only a couple of hours or if you can spend the entire weekend with us, your help would be greatly appreciated.

If you can help, please send an e-mail to Steve:

n9ip@amsat.org

Help Wanted - AMSAT Store Co-manager

AMSAT is looking for an on-line store co-manager. Your efforts will involve updating and refreshing the osCommerce based AMSAT Store web page when new merchandise becomes available or prices and shipping costs change. Shipping and credit card charges are handled by the AMSAT Office.

- Add new merchandise offerings
- Delete merchandise no longer available
- Update shipping costs as needed
- Add periodic updates for registrations for Dayton and the Symposium
- Interface with the AMSAT Office

To volunteer send an e-mail to JoAnne Maenpaa, K9JKM at: k9jkm@amsat.org.

AMSAT 2015 Field Day Announcement - June 27-28

It's that time of year again: Field Day!

Each year the American Radio Relay League (ARRL) sponsors Field Day as a "picnic, a campout, practice for emergencies, an informal contest and, most of all, FUN!" The event takes place during a 24-hour period on the fourth weekend of June. For 2015, the event takes place during a 27-hour period from 1800 UTC on Saturday June 27, through 2100 UTC on Sunday June 28, Those who set up prior to 1800 UTC on June 27 can operate only 24 hours. The Radio Amateur Satellite Corporation (AMSAT) promotes its own version of Field Day for operation via the amateur satellites, held concurrently with the ARRL event.

If you are considering ONLY the FM voice satellite SO-50 for your AMSAT Field Day focus - **don't** - unless you are simply hoping to make one contact for the ARRL rules bonus points. The congestion on FM LEO satellites was so intense in prior years that we must continue to limit their use to one-QSO-per-FM-satellite. This includes the International Space Station. You will be allowed one QSO if the ISS is operating voice.

You will also be allowed one digital QSO with the ISS or any other digital, non-store-and-forward, packet satellite (if operational).

Many good contacts can be made on the linear transponder satellites including AO-73, FO-29, and AO-7. During Field Day the transponders come alive like 20 meters on a weekend. The transponders on these satellites will support multiple simultaneous SSB or CW contacts.

The 2015 AMSAT Field Day event is open to all Amateur Radio operators. Amateurs are to use the exchange as specified in ARRL rules for Field Day. The AMSAT competition is to encourage the use of all amateur satellites, both analog and digital.

The complete listing of the 2015 AMSAT Field Day Rules will be posted soon on the AMSAT web.

The Satellite Attitude Manipulating System (SAMS) Prototype

Mark Spencer, WA8SME
wa8sme@comcast.net

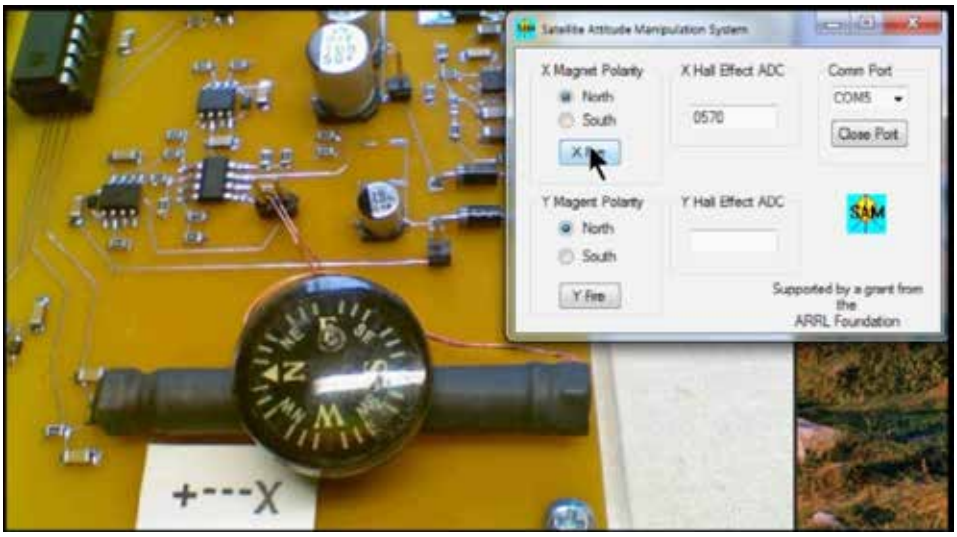
Background

Jim White, WDØE, authored an exceptional article (*MICROSAT MOTION, STABILIZATION, AND TELEMETRY (and why we care about it)*) published in the September 1990 *AMSAT Journal* covering passive magnetic attitude stabilization with photon assisted spin. He prophetically stated (university CubeSat programs---take heed):

Studies…falling into the general category of motion and stabilization are ripe for further investigation… (The (sic)) Following is a summary (in no particular order) of those study areas. It is not exhaustive, but is included here in an attempt to show the richness of further investigative opportunities, and in the hope that it will stimulate those interested in amateur satellites, or just in satellites, to participate in this fascinating field.

Exactly when and why does a Microsat's Z axis wobble? What is the cause of the wobble? Can we understand enough about the cause to predict when it will occur and its amplitude? There is a component of precession in the roll over that occurs at the equator. Exactly how much does the Z axis deviate from the orbit plane during this event?

- *What is the nature of WEBER wobble as compared to the others? ... How does that affect its susceptibility to wobble?...*
- *What are the effects on the RF links of the wobble? Can predictions be correlated to measured signal strength and polarization changes? ...What are the best simple ground station antennas to use when wobble is present and when it is not?*
- *Exactly how quickly did each Microsat achieve magnetic lock. What was the nature of the motion (tumble) in the first few days? ...*
- *Exactly when did PACSAT turn around, and how much, if any, tumble occurred at that time? After it turned around, what was its spin rate each day until it reached a stable rate? How did the temperatures in PACSAT change as its spin slowed down to zero about February 17th? How hot did the +Y surface get when it faced the sun for long periods?*
- *What is the DOVE spin rate currently, and how fast did it increase since it came out of tumble? WOD collection of the array currents is planned using a 2 second sample rate. This should allow accurate determination of the spin rate, and also tell us if DOVE's roll over at the equator is delayed or affected at all by its higher spin rate.*



Watch a tuorial video of the SAMS Experiment on the AMSAT Web: http://ww2.amsat.org/xtra/SAM%20Introduction.wmv

The complete prototype circuit diagram, parts list, board artwork (for ExpressPCB), the PIC software, and the Visual Basic GUI software are available upon request - contact me at: wa8sme@comcast.net.

I have selectively edited Jim's list to make it more relevant to today, but his point is just as valid today as 25 years ago…AND we are in a far better position today, technology wise and in the sheer number of available space borne assets, to revisit, or perhaps visit for the first time, this list.

Later in December 2009, Drew, KO4MA announced: *"...On the 2242UTC pass of AO-51 tonight [Wednesday, Dec 2], we will try for the first time to reverse the magnet and "flip" the orientation of the satellite… If the reversal is successful, we should see some changes in signal levels and patterns. This particular maneuver has not attempted since launch…In related news, as the spacecraft spin inexplicably continues to slow, we are seeing increasingly larger dips in the spacecraft voltage when the panels are poorly aligned to the sun. The immediate result of this is that we have had to decrease the power on both transmitters to prevent discharging the batteries too deeply.*

We'll be working on mitigating strategies this coming month. This may include using existing software routines to automatically lower the downlink power during these dips in power production, or resolving to run one transmitter at a time instead of simultaneous digital and repeater downlinks…"

Just by chance I had previously developed a system and procedure for tracking the signal strength of AO-51, so I was ready with archived data when the flip occurred. I dusted off the system and employed it during the flip experiment to see just what happened to the quality of the downlink, but of more interest to me, just how long it took for the spacecraft to recover from the flip. Figures 1, 2, and 3 depict the baseline pass, a flipped pass, and a back to normal pass (re-flipped) respectively. It took approximately 19 days to stabilize after being flipped, and 11 days to stabilize after re-flipping. You can see significant fades in the downlink signal strength during the period that the satellite was recovering from the flip maneuvers when compared to the pre-experiment, typical pass signal strength profile.

While MEMS gyros were at that time a gleam in someone's eyes, and using downlink signal strength provided some insight into what was happening…it certainly only reinforced the questions raised by Jim White 17 years earlier while adding more questions to the list.

Then comes FunCube, launched in November of 2013, it started some erratic rotation behavior approximately one month into its orbital tenure that persists to this day. Figure 4 is a graph of the FunCube rotation rates up to the time of this article. While the rotation rate first appeared chaotic, a periodicity began to appear. With no real

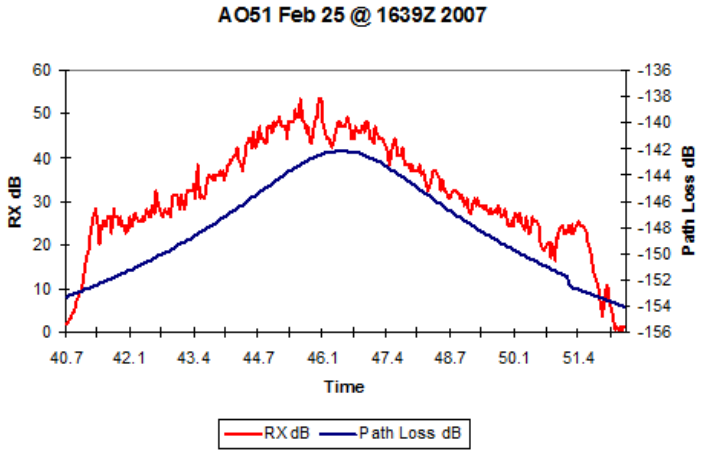


Figure 1: Baseline Pass

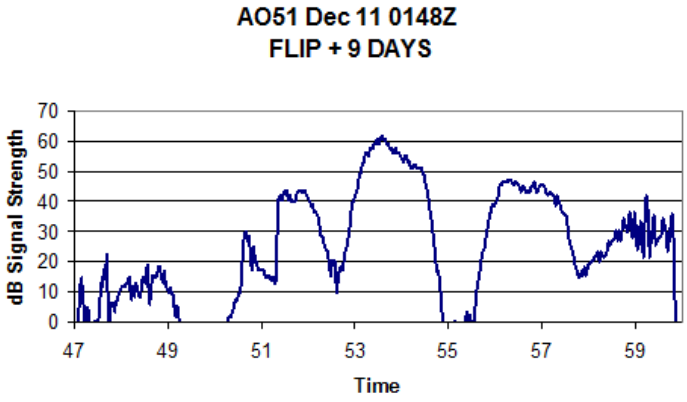


Figure 2: Flipped Pass

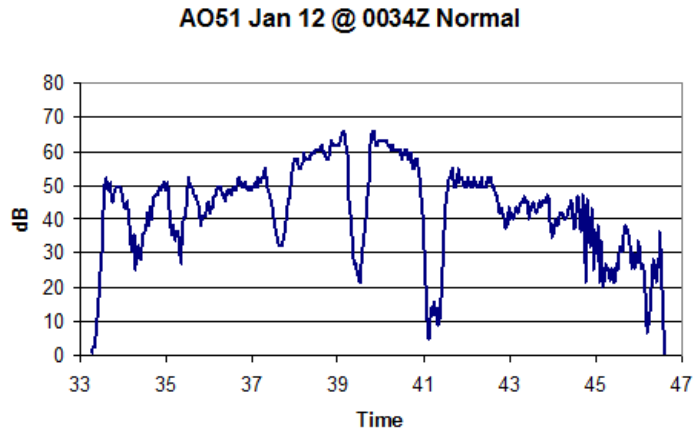


Figure 3: Re-flipped back to normal

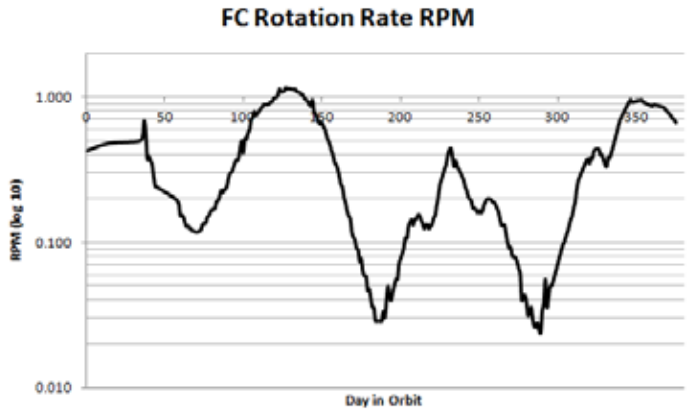


Figure 4: FUNcube rotation rate

scheme to impart rotation, the behavior of FunCube has been an exceptional learning platform that also reinforces the questions raised by Jim White 23 years earlier…and caused me to develop the concept of this article.

Fast forward to today. We are deploying a dizzying number of CubeSats on a routine basis. Sensor technology has advanced (thanks to the cell phone industry) to the point that attitude determination sensors are common place and inexpensive (not to mention so small it takes magnifying glasses to see the darn things). What I am proposing is that we as a satellite community pursue a CubeSat dedicated to addressing some of those questions posed by Jim White. I propose that the experiment carried on-board this satellite be dynamic in nature as opposed to a static experiment (the difference will be defined later). To address Jim's questions, we will have to deliberately maneuver and flip the satellite around and watch what happens (and as I am sure that Drew can attest, doing so is going to be a knuckle whitening experience)…a risky proposal to say the least. But why? In my view, I see an ever increasing need for CubeSat attitude determination and control simply because of the proliferation of very affordable and capable sensors being deployed on CubeSats that make passive attitude determination and control possible…and required to take advantage of the capabilities these sensors provide.

I asked myself this question, "if I were to be able to put an experiment on a CubeSat, of such complexity and rigor that it could be designed and built by the typical university student team of young engineering and teacher candidate students, what would it be?" The answer, SAMS, or Satellite Attitude Manipulation System. SAMS is basically a set of three variable, reversible permanent magnets installed along the X, Y, and Z axis of the CubeSat that can be manipulated by student input to cause a deliberate change in the attitude and rotational behavior of the CubeSat so that students can observe the outcome, make adjustments in response, and do it again. Certainly not a new idea, Drew and AMSAT did it with AO-51, but also different. I have advanced SAMS to the concept demonstration prototype stage. It awaits a student or team of students to take it to the next level and perhaps put it on orbit.

The foundation of SAM is the magnet made of Alnico alloy (aluminum, nickel, and cobalt). Alnico based magnets can produce strong magnetic flux in a closed magnet circuit, but have relatively small resistance against demagnetizing. This means that Alnico magnets can be magnetized by an induced field, but also can have the field strength varied in intensity by manipulating the field even to the extent of producing a reversed or flipped field (North to South and vice-versa), thus what I referred to as variable, reversible, permanent magnet.

Figure 5 illustrates the microscopic magnets within the Alnico material when predominantly aligned either North or South to produce a magnetic field that is saturated (as strong as it gets). This alignment is induced in the material by an external field produced for instance by inserting the Alnico magnet inside a coil and applying a current

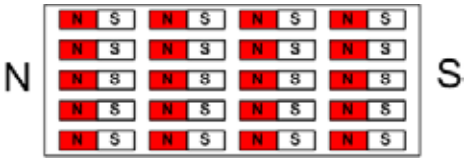


Figure 5: Magnetic dipole alignment toward "North" bound saturation.

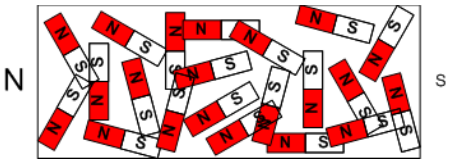


Figure 6 Pulsing changing magnetic dipole toward neutral.

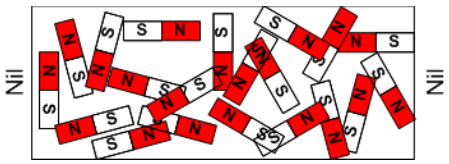


Figure 7 North: Magnetic dipole alignment in neutral.

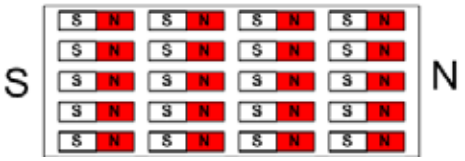


Figure 5: Magnetic dipole alignment toward "South" bound saturation.

through the coil of appropriate voltage and current (in the case of SAM, the voltage applied to the 5 ohm coil is approximately 26 volts). But also, by incrementally pulsing the coil in the opposite direction, the induced magnetic field can be manipulated in the opposite direction by causing increasing number of microscopic magnets within the Alnico material to reverse, as is illustrated in Figure 6 (more of the microscopic dipoles are N-left, S-right giving a net, but reduced N left polarity). Continuing to incrementally pulse the coil will further shift the Alnico pole toward neutrality as illustrated in Figure 7. Going to the other extreme, eventually the added pulses (or one long pulse) to the coil will result in full pole reversal. So, the strength and direction of the Alnico magnetic field is controlled by the magnitude of the applied field as well as the duration the field is applied.

The SAM circuit that controls the magnitude and duration of the applied field is depicted in the block diagram of Figure 8. A PIC Microcontroller manages the system. The PIC waits for specific commands sent by the satellite ground command element that are passed through the command bus lines. When demanded, the PIC turns on the buck-boost circuit that boosts the voltage supplied by the solar panels through the power buss (around 4 volts) to the approximately 26 volts required to manipulate the field of the Alnico magnet. This stepped up energy is stored in two electrolytic capacitor banks: one bank provides the current to energized the coil; the other smaller bank provides a controlling voltage source for the high-side FET switches controlling the H-bridge. When the capacitors are at the appropriate charge, as sensed by the ADC of the PIC, the buck-boost is turned off (this takes about 25 milliseconds as shown in Figure 9). The PIC then sets up the H-bridge for the correct current path to set the commanded Alnico field orientation and "fires" the H-bridge by applying the energy stored in the capacitor bank to the coil. This pulse lasts approximately 5 milliseconds. The PIC then reads the value of the induced magnetic field from the Hall Effect sensor that is affixed near the end of the Alnico magnet. If additional pulses are required, the process is repeated. Finally, the PIC reports the final Hall Effect sensor reading back to the ground station via telemetry. Things are powered down and the satellite goes along its wobbling ways while the students watch (MEMS gyros, solar panel currents, sun sensors, temperature sensors, etc.).

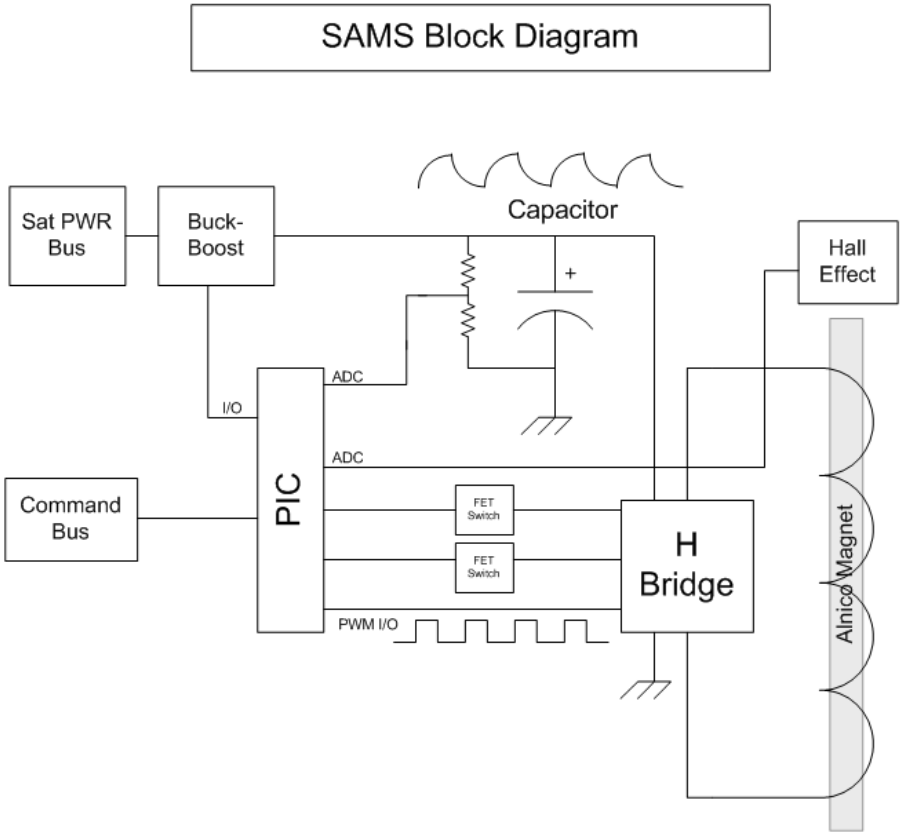


Figure 8.

The completed prototype board is depicted in Figure 10.

CubeSat experiments generally are static in nature. What I mean by static is that the experiment hardware is installed on the satellite, and the controlling software is turned on at the appropriate time. Data is collected and reported down via telemetry, and finally the data is interpreted and monitored (Figure 11). The FunCube Materials Science Experiment is an example. Once initiated, a static experiment is monitored and that is about it. I am being hypercritical; in fact a static experiment on a CubeSat is an exceptional learning opportunity and huge insights can be gained from the collected data. But an alternative experiment, one that is dynamic in nature, could take the learning opportunities to a whole new level (but admittedly with some risk involved). In a dynamic experiment, something can be changed on board the satellite that produces some measurable outcome that is evaluated. The outcome of this evaluation is a new or amended experiment that is uploaded to produce some change on board the satellite and the process continues. The experiment proposed in the SAM concept is a dynamic experiment (Figure 12). There are risks when conducting dynamic experiments, and these risks must be managed. In the SAM case, any student plan to change the magnets on the spacecraft must first be reviewed and scrutinized by the satellite operations team to ensure that the planned maneuver will not damage or result in the loss of control of the satellite. Once approved, the satellite operations team will upload the mission plan and trigger its execution.

In my not-so-humble opinion, dynamic experiments allow students to DO space borne experiments, not just witness space borne experiments. I will repeat my offer, if you would like additional information on this project, particularly if you are a student or student group, I can be reached at :

wa8sme@comcast.net.

Now time for a commercial message. The SAMS prototype and other hardware that supports the use of the FunCube Materials Science Experiment (the Leslie's Cube system and the MSE Simulator) were made possible in part by a grant provided by the ARRL Foundation. I offer my sincere thanks for allowing me to tinker with the concepts. I have time to contribute, but their support helps soften the out of pocket expenses of buying the bits and pieces needed to make the hardware. Check out the ARRL Foundation at:

http://www.arrl.org/the-arrl-foundation.

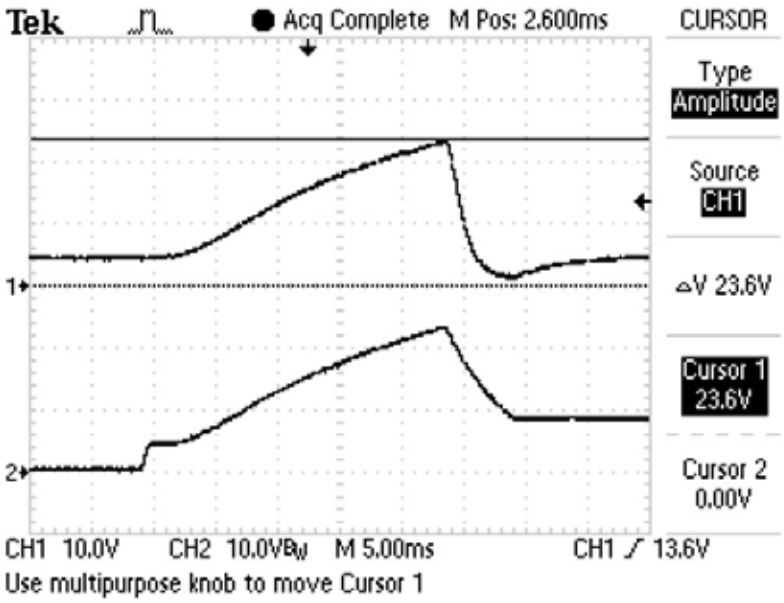


Figure 9: Waveform capture of switching time.

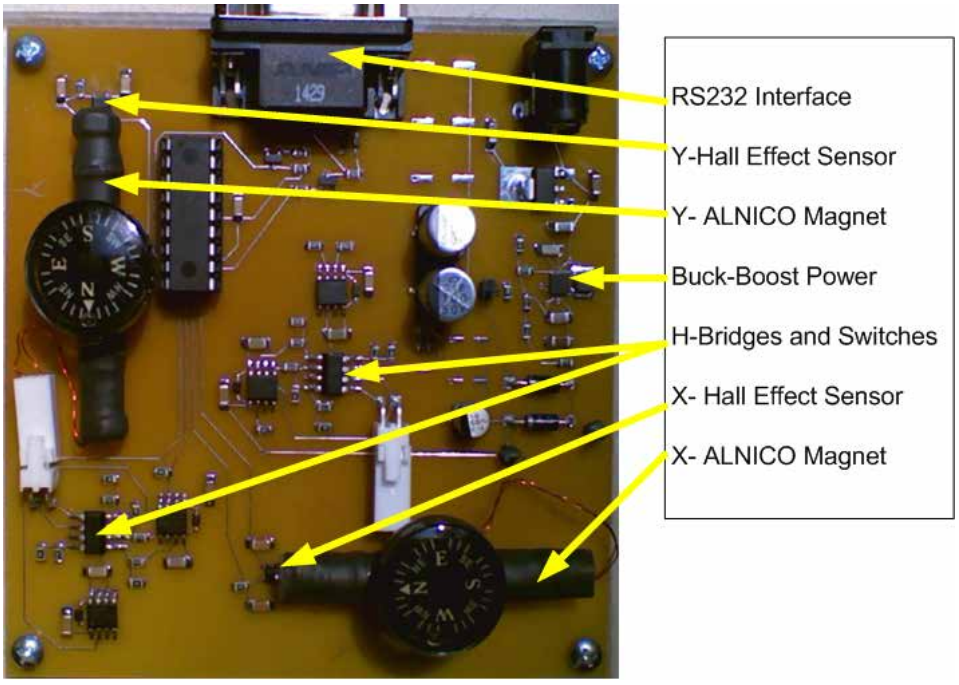


Figure 10: Completed prototype circuit board.

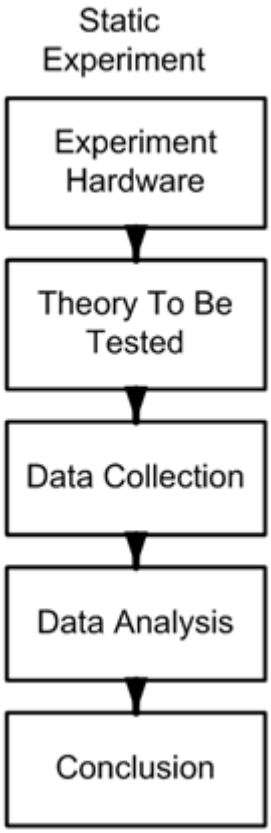
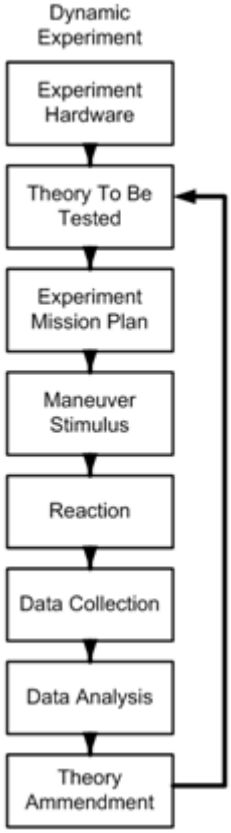


Figure 11 (left): The flow of a static experiment is that the hardware is installed on the satellite, and the controlling software is turned on at the appropriate time, data is collected and reported down via telemetry, and finally the data is interpreted and monitored.

Figure 12 (right): The flow of a dynamic experiment requires observation, measurement and analysis to determine the risks requiring management.



AMSAT Nets

Keith Pugh, W5IU
w5iu @amsat.org

This paper presents the history of how the AMSAT News Service relayed information across the country and around the world from the early days until the present. Emphasis is on the HF nets - the bands, the people, the information. The VHF nets are discussed briefly. The question is raised: Do we still need them today?

Yesterday

HF - Since the early days of amateur radio satellites, AMSAT has operated a series of HF nets to disseminate timely news and data necessary for operation on the satellites. In the true spirit of amateur radio, these nets were originally organized to relay the information across the country and the world. In the early days, the Internet did not exist and weekly nets operating on various HF bands were the most effective means available to spread the news and data. The HF nets also served as places for interested amateurs to learn about amateur radio satellites and for experienced satellite operators to share experiences, hints and kinks, etc., with the newcomers to the ranks. In the early days, a lot of time was consumed doing a voice relay of the current Keplerian data.

Nets operated on several of the HF bands: 75, 20, 15, 17, and 10 meters. Typically the information flow started on the East Coast 75 Meter Regional Net and was relayed to the Mid America and West Coast nets in turn. This was done in a three hour time slot on Tuesday evenings starting at 2100 Eastern Time. The Mid America Net came on at 2100 Central Time and was followed by the West Coast Net at 2000 Pacific Time. The same basic information was used on the 20, 15, and 17 meter nets that met on Sunday afternoons and the 10 meter net on Saturday. Late-breaking items were added as they came up. Over the years the 15, 17, and 10 meter nets were greatly affected by changes in the sunspot cycle and did not operate in the poor years. Eventually these three nets were dropped altogether.

A similar series of nets operated in the United Kingdom for many years. Additional nets existed

Keith Pugh has been an active amateur radio operator since August, 1953, and has been active in AMSAT since 1982 starting with AO-8. During the early days of AO-40 he held the position of AMSAT VP of Operations. He holds an amateur Extra class license and is a retired Radar and Navigation Systems Engineer from Lockheed Martin Aeronautics Company. He has been active on all of the AMSAT HF nets since 1982 and currently is the lead net control station on the AMSAT 20 Meter Net. Keith is an AMSAT Area Coordinator in the Dallas and Fort Worth area.

in other parts of the world. When propagation permitted, information was relayed between the North America and United Kingdom nets, usually during the 20 meter net.

No discussion of AMSAT HF net history would be complete without mentioning at least some of their voices over the years. In North America the ones that come to mind are Vern (Rip) Riportella, WA2LQQ; Jim McKim, W0CY; Wray Dudley, W8GQW; John Browning, W6SP; Bill Tynan, W3XO; Ron Long, W8GUS; Byron Lindsey, W4BIW; and John Shew, N4QQ. In the United Kingdom they are Ron Broadbent, G3AAJ; Pat Gowen, G3IOR; and Richard Limebear, G3RWL. Most of the information flow between the North America and United Kingdom nets went between Pat, G3IOR, and Rip, WA2LQQ. Unfortunately, many of these voices are now Silent Keys.

Many fond memories of these days exist, but a return to these nets as they existed in the past is not necessary.

VHF – A number of local VHF nets have operated throughout the country for many years. The listing of these nets is in need of revision for accuracy. One of these, the Houston AMSAT Net, has weathered the storm well and has been updated to adjust to the times.

Today

The HF nets are now reduced to the 20 meter net on Sunday. Operation of this net follows:

20 Meter International Net – Until recently, this net met at 1800 UTC, Sunday afternoons, on 14.282 MHz. Co-hosts for the net were typically Keith Pugh, W5IU, and Larry Brown, W7LB. Occasionally, other regulars help out. The first hour, known as the "Pre-net Warmup" was informal discussion of amateur radio satellites, requests for information, and check-ins. At 1900 UTC, the weekly AMSAT News Service (ANS) Bulletins for the week were read by Keith Pugh, W5IU, with his beam antenna pointed east from Fort Worth, TX. At 1930 UTC the second reading of the ANS Bulletins was done by Larry Brown, W7LB, on an inverted V from Tucson, AZ. Larry's coverage is primarily the west coast and the Midwest. Variations on this routine occur due to absences and other activities on the band. Sometimes, W5IU did a second reading with his beam pointed west. Sometimes, W7LB did the only reading from Tucson. As time permitted, status of the currently active satellites was given and any additional time was used for Q & A.

Presently, the AMSAT 20 Meter Net has changed format. This change took effect on 9 November 2014. It now starts with check-ins at 1900 UTC on 14.282 MHz and proceeds with satellite Q & A and other topics. The weekly AMSAT Bulletin titles are read and an offer is made to read or discuss specific bulletins by request. Operators are encouraged to read the full text of the bulletins on the AMSAT web page. We encourage check-ins from AMSAT officers, BOD members, operators that are very active on the satellites, and, of course, operators that are new to the satellites and/or ham radio. The activity is generally over by 2000 UTC. The same two hosts continue to share the NCS duties and we attempt to cover the entire US as much as propagation allows. We also attempt to involve Europe and other parts of the world but, but so far, this hasn't been successful except for Canada. An active east coast net control station would help this situation.

We realize that not everyone has 20 meter capability but we need more activity to continue running this net. Dust off your HF gear, put up a 20 Meter dipole, and join us.

Houston AMSAT Net – This net continues to operate on Tuesday evenings at 2000 CST or CDT. In addition to VHF coverage in the Houston area, it incorporates EchoLink into its format and listeners over EchoLink are able to ask questions via text messages on EchoLink. Telephone lines are also monitored to receive check-ins and questions. Variations on this format exist in other areas.

Other VHF Nets – Other nets continue to operate with varying degrees of success. The one I'm most familiar with is the Dallas/Fort Worth Metroplex AMSAT Net on Wednesday evenings at 2100 Local. This net features rotating net controls to share the wealth. It starts with check-ins then follows with bulletin reading, round-robin sharing of recent experiences, Swap Shop, and finally Tech Talk. It usually is over in an hour. There are variations on this format with different NCS Stations.

Again, we are in need of a comprehensive update of this net information.

Tomorrow

The function of disseminating the ANS Bulletins, Keplerian data, etc. is now done more efficiently by the Internet; however, there are still operators out there that prefer to receive their information via radio or have not yet joined the computer generation. Introduction of operators to satellites is sometimes done better via the nets than by the cold printed word. Discussion of the relative merits of equipment, hints and kinks, and general Q & A is many times better accomplished by on the air contact via the nets. For these reasons, the nets continue to have a place.

As a minimum, the current 20 meter HF net should be maintained. More net control stations must be recruited to share the wealth and fill in the gaps when there are absences. Additional help could also be used to expand the coverage.

Following the example of the Houston AMSAT Net, more use should be made of new technologies to involve VHF, UHF, and the Internet in net operations.

Existence of these nets must be better documented and publicized via bulletins and on the AMSAT Web Page.

Summary

Let's keep the 20 meter HF net healthy and pump some new blood into it. Expand the use of local VHF and UHF nets where possible. Look over your capabilities and consider helping out with the AMSAT nets in the future. Sharing of experiences by experienced operators is particularly useful.

29 MHz Uplinks: A New Alternative

Ray Soifer, W2RS

The 145 and 435 MHz amateur-satellite band segments are very crowded, leading an increasing number of satellite builders to explore alternatives. For many, such as those requiring bandwidth greater than 12 or 15 kHz, the best answer will be found in the microwave bands.

However, for those who can use it, the IARU band planning process has now opened another alternative: 29 MHz uplinks.

The band segment 29.300-29.510 MHz has been used for amateur-satellite downlinks for more than 40 years. However, this would not be practical for most of today's very small satellites, owing to the size of the antennas involved. Fortunately, uplinks at this frequency are very practical, even with small receiving antennas, because transmitting power at the earth station is easy to obtain. The following example will illustrate:

- At a slant range of 2000 km, the path loss is (only) 128 dB. Doppler shift is 0.6 kHz or less.
- The FM sensitivity at 29 MHz of a typical amateur VHF/UHF handheld transceiver with HF receive coverage, in this case a Yaesu VX-3, is 0.35 uV (-116 dBm) for 12 dB SINAD.
- The "gain" of a loaded 29 MHz antenna the size of one for 145 MHz will vary with the situation, but would typically be on the order of -10 dBi.
- A typical amateur transmitter or transceiver for 29 MHz will produce 100 watts output. For simplicity, we will assume a unity gain transmitting antenna such as a ground plane, resulting in a signal strength at the receiver of -88 dBm and a safety margin for the link budget of 28 dB.
- A "worst case" analysis, with a receiver sensitivity of 1 uV and a -15 dBi receiving antenna, would still leave a safety margin of 13 dB, which should be more than adequate.

Jerry Buxton, NØJY - Vice President – Engineering
nØjy@amsat.org

Fox-1 is completed!

You have probably received that bit of news from one or more of the AMSAT News Service and AMSAT social media outlets, but the importance of the event is worthy of repeating. With launch set for August 2015, the first of the Fox-1 series of CubeSats is ready to go to orbit!

Environmental testing was the final step of the actual construction and testing of the Fox-1 flight unit and it took place the week of January 18 in Orlando, FL. Team members Bob Davis KF4KSS (mechanical engineer), Burns Fisher W2BFJ (software engineer) and myself with Fox-1 in tow were all involved in the final measurements, preparations, testing, and post-testing over a 5-day period. It started Tuesday morning in a hotel room where the necessary measurements and steps were performed to put Fox-1 in the TestPOD, a 1U P-POD type device designed for use in the vibration testing. Arriving at the facilities of Qualtest that afternoon we found that another customer was still underway on the vibe table so we spent the afternoon getting to know the Qualtest folks and the facility. Wednesday morning we were back and performed the vibration tests. Fox-1 had to be subjected to vibrations of up to a little over 22G and in all three X, Y, and Z axes in order to satisfy the CubeSat to P-POD ICD requirements that our little CubeSat would not fly apart during launch and harm the primary payload or launch vehicle. The photo shows the brief celebration when Fox-1 passed her Short Function Test and Aliveness Test after that major shakedown!

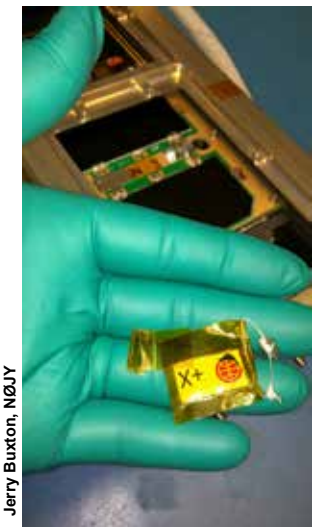
Once vibe testing was done the Thermal Vacuum Bakeout began on Thursday with a 12 hour pre-soak bringing the temperature to 50° C. at a vacuum of less than 50 milliTorr which is as low as the roughing pump would handle. This was necessary to remove any major contaminants prior to performing the ICD required bakeout to avoid damage to the ion pump, which is used to bring the vacuum chamber pressure down to the level needed for qualification. Fox-1 was not in the Test POD for this procedure. After coasting overnight we began the required bakeout very early Friday morning and brought Fox-1 up to 60° C. and the pressure below $1x10^{-4}$ Torr for six hours to bake out any contaminants in and on the components and structure so that they would not become a problem when Fox-1 hits the vacuum of space. Friday night it was done. We performed the Short Functional Test

The Fox-1 environmental test team: Jerry, NØJY; Bob, KF4KSS; and Burns, W2BFJ, celebrate passing the Short Function Test and Aliveness Test at the conclusion of 3-axis vibration testing with acceleration up to 22 G. The five day test period also included thermal-vacuum testing to very low pressure and high temperature in order to remove any contaminants left over from construction and handling.

On March 25, 2015 AMSAT Vice-President of Engineering, Jerry Buxton, NØJY, reported on the achievement another milesone leading the launch of Fox-1A.

Fox-1A, having passed all integration and environmental testings, and successfully completed a Mission Readiness Review, was delivered by Jerry to the launch integration team at Cal-Poly in San Luis Obispo, California.

Fox-1A was integrated with the P-POD cubesat deployer in preparation for being loaded on the launch vehicle.



(left) Fox-1A integrated with the P-POD deployment cannister.

(right) The "Remove Before Flight" pin was pulled by Jerry at the completion of his work on system integration and prior to closing all of the side panels on the P-POD.

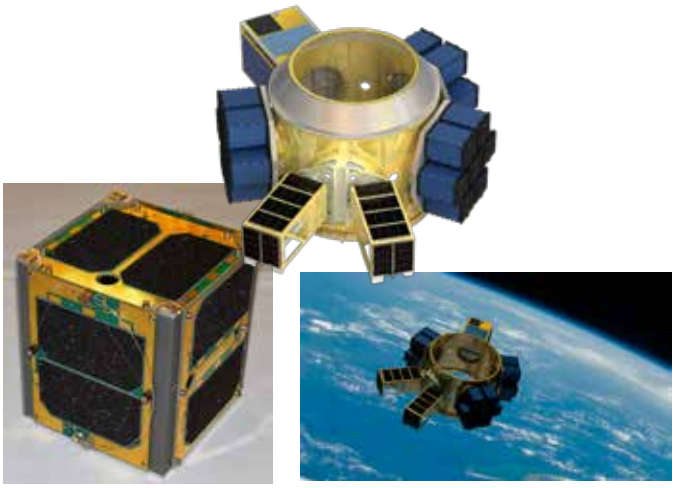
and Aliveness Test one final time then put Fox-1 "in the bag" to come home with me – an anti-static bag where she will remain except for occasional battery charging until delivery and integration, to keep her "generally clean".

The Fox-1 Mission Readiness Review (MRR) was held February 24 at the SRI facility in San Luis Obispo, CA. With NASA, NRO, SRI, Cal Poly, and Tyvak representing the review board, AMSAT and the four other ELaNa XII satellites each underwent about a two hour review. The purpose of the review is to present the evidence and documentation that shows that each of the requirements of the CubeSat to P-POD ICD (interface control document) are satisfied. These requirements are designed to protect the primary payload, launch vehicle, and other CubeSats on the mission. The flight readiness and operations plan are also reviewed to look at the mission success of the individual satellite, and significant anomalies are reviewed to understand the challenges faced by each team.

NASA requires their ELaNa satellite teams to be on site for the MRR and it is a good opportunity. Being in the same room with your mission sponsors and the launch service provider teams and having the opportunity to ask as well as answer questions makes for a very comfortable and complete review.

There is no "final outcome" from the review. As the word implies it is an opportunity to go over all of the requirements and each team, as well as the review teams, came away with action items to take care of in order to submit a final review. That will then be passed up the chain to the launch provider so that they can be aware of the status of their "hitchhikers".

And this is not so much an end but also the beginning of the rest of the Fox-1 Project. Fox-1 delivery and integration will take place the week of March 23, and the AMSAT Engineering Team is already busy working on Fox-1C and her flight spare Fox-1D for launch later this year. Fox-1D will be fully tested and ready to step in right up to launch integration should Fox-1C suffer a mishap. And Fox-1D will also be truly "on the shelf" ready for handover on other launch opportunities that are on our radar. That saves AMSAT money not only on the Spaceflight launch of 1C (as standard practice, we have to pay whether we launch a satellite or they launch a mass simulator in our place) but on the testing which can take place for both in one trip, reducing travel expenses. We will then have three fourths



Fox-1C will be delivered to orbit on a launch purchased by AMSAT from Spaceflight, Inc. This will be the maiden launch of Spaceflight's SHERPA deployment system. Fox-1C will be loaded into a QuadPack, made by ISIS - Innovative Solutions In Space B.V. from the Netherlands, which is a versatile nanosatellite dispenser that combines the benefits of launching containerized payloads with configuration flexibility in terms of payload size, provided the payloads follow the popular CubeSat standard. The ISIS QuadPack offers a single system that can accommodate four separate 3-Unit launch tubes, or two 6-Unit launch slots, or accommodate a single 12-Unit nanosatellite within the same outer envelope. These ISIS QuadPack dispensers will be used with Spaceflight's SHERPA system. SHERPA is capable of deploying a volume of 84U of cubesats on the initial flight. It is capable of carrying up to 1,500 kilograms total although the first mission, set for the third quarter of 2015, will fly with 1,200 kilograms.

of the Fox-1 series done 3Q this year with only Fox-1B "RadFXSat" left to finish for a launch which is tentatively on the calendar for July 2016.

While Fox-1 will not yet be in orbit by the time we finish Fox-1C/D we learned a lot about both CubeSat design/construction as well as our processes in producing Fox-1 and these lessons will be applied to the rest of the Fox-1 series and even to our future CubeSats.

These are exciting times indeed, with the prospect of no less than three and possibly four Fox-1 satellites going to orbit within the next 18 months.

The Fox-1 series has gained notoriety and AMSAT has had several inquiries from institutions wishing to partner to fly experiments on a Fox-1 satellite. Of course you are familiar with the Penn State – Erie and Vanderbilt experiments on Fox-1. For Fox-1C Virginia Tech will finish the camera (which missed the Fox-1 deadline) and we also plan to fly a VT camera on Fox-1D. The Vanderbilt Fox-1 flight spare experiment will also fly on 1C along with the Penn State experiment which is a "normal" part of the IHU now.

A recent partnership we gained with the University of Iowa during the second half of 2014 will bring their High Energy Radiation CubeSat Instrument – "HERCI" to Fox-1D. Additionally, we are looking at an in-house experiment for Fox-1D that I'll share more about as we see how that develops.

Finally, late last year the Columbus Space Program approached us and we partnered on a CSLI (NASA CubeSat Launch Initiative) proposal to fly their "FluxDemonSat" on what would be our Fox-1E, the last unit built as the spare for RadFXSat. Unfortunately, their CSLI proposal was not accepted.

There are also other university partnership proposals under discussion that may be part of our next satellite series, and the successful launches of the Fox-1 series will serve to add flight heritage to our CubeSat educational partnering abilities.

We are also looking toward the future and our next satellite(s). We are building up the engineering team and exploring ideas for what might be next. And your input is requested. The Design the Next AMSAT Satellite door is still open. As I said these are exciting times, indeed!

ARISS SSTV Results February 22 - 24

Following a short delay in amateur radio operations aboard the ISS due to schedule changes in EVA activity, the Slow Scan Television transmissions were sent on Sunday, Monday, and Tuesday, February 22-24. The transmissions originated from the Russian segment of the ISS using a modified Kenwood D710 radio and an external antenna on the ISS. The callsign of RS0ISS was used.

SSTV signals received on 145.800 MHz using the PD180 high resolution mode featured 12 different photos of the first cosmonaut Yuri Gagarin. Also included was a photo of a commemorative diploma created by the National Polish Amateur Radio Society celebrating the 80th anniversary of Gagarin's birthday.

Images received by radio amateurs world-wide may be viewed on-line at:

http://www.spaceflightsoftware.com/ARISS_SSTV/

Enthusiastic comments posted on amsat-bb indicated world-wide success:

- Fer, IW1DTU wrote, "ISS SSTV, strong signal."
- Roland, PY4ZBZ posted his picture that he received in Brazil 22 Feb 2015: http://www.qsl.net/py4zbz/satelite/Hist33.jpg
- Ken, GW1FKY commented, "Received very strong and clear pictures using my Kenwood THD-7 on a pass 1416 hrs plus, at my QTH in Wales UK. This was despite very heavy rain and severe flooding in the area.
- Greg, KO6TH wrote, "I've never received a clearer SSTV picture from anywhere, let alone outer space! Using a Yaesu FT-847 and MMSSTV software running under Wine on my OpenSuSE Linux box."
- Steve, AI9IN wrote, "Just got a nice download of picture 12/12 Series 1 from ISS. Have a 5/8 wave vertical on the roof going to an old Yaesu 2M multi-mode used MMSSTV. My first SSTV from the ISS!"
- AMSAT-UK posted a summary of SSTV resources to help amateurs prepare for future transmissions from the ISS. See:

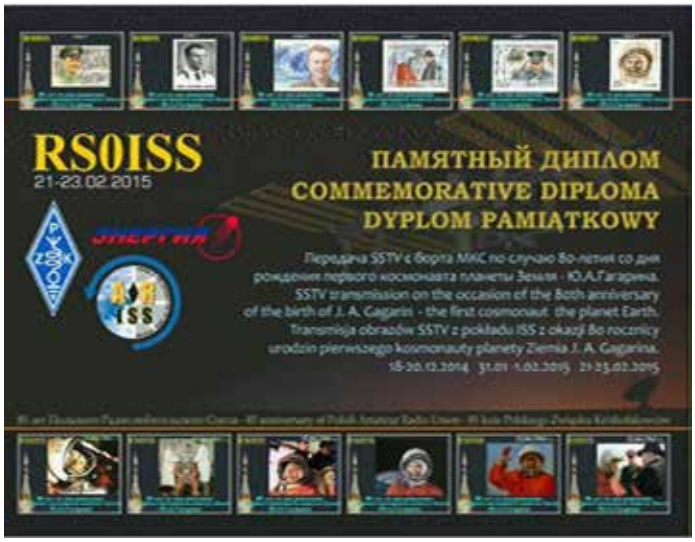
http://amsat-uk.org/2015/02/11/more-iss-slow-scan-tv/

Martin, G8JNJ reported excellent SSTV signals from the ISS using the online SUWS WebSDR which will receive the ISS and the many amateur radio satellites transmitting on 144-146 MHz band, high altitude balloons in the 434 MHz band, 435-438 MHz satellite band and microwave coverage of 10368-10370 MHz band at:

http://websdr.suws.org.uk/

SSTV photo received by LASA High School Amateur Radio Club, K5LBJ

SSTV photo received by Sebastien Gevry, VE2TSG



SSTV photo received by Jack Weimer KC7MG

Photo Credits: ARISS SSTV Gallery
http://www.spaceflightsoftware.com/ARISS_SSTV/

AMSAT at the Orlando HamCation

AMSAT was represented at the 2015 Orlando Hamcation February 13-15. which hosted 14,000 people. The inside booth is shown above with Lee, KU4OS, Lou, W5DID, and Drew, KO4MA. Dennis Veselka, KI4KNC, (not pictured) provided outstanding support for booth operations.

John Papay, K8YSE, set up his internet station at the booth to use both his Ohio and Arizona remote stations for satellite contacts. John's station outside with an Arrow antenna on a tripod resulted in several contacts. Most of his demos usually drew between 10 and 20 people per session.

Lou, W5DID gave a 1 hour forum providing updates on the Fox program and the ARISS DATV project

(left) Lee, KU4OS, one of the ANS editors, and (right) Lou, W5DID.

AMSAT-NA and M2 Antenna Systems are pleased to announce that the LEO-Pack system is being offered to members only at $499, shipping included (US only). Non-members can join AMSAT-NA at time of purchase to participate in this special purchase. To place your order, visit the AMSAT store at: http://store.amsat.org/catalog/ M2 Antenna System's LEO-Pack page can be found at: http://tinyurl.com/nyhgmcr

M2 unveiled LEO-Pack, a new circularly polarized VHF and UHF satellite antenna at the HamCation. M2 awarded one of their new LEO-Pack antennas during the AMSAT forum. Shown (L-R) Robert Brown, KR7O, M2 Amateur Marketing and Sales manager, presenting the prize to David Springer, K4YQJ, with David Jordan, AA4KN looking on.

Rotor Controller Box/Boards Available

LVB Tracker Box

- Reasonably priced and all profits go to AMSAT
- Serial interface standard
- USB interface may be easily added by user
- Open software
- Open architecture
- Built-in rotor interface cable with DIN connector
- Power supplied via the rotor controller cable
- Bi-directional interface allows the unit to read the rotor position
- LCD position readout
- Front panel manual control
- Self-programmable, allows for easy software upgrades
- Supported by the major tracking programs
- Uses GS-232A or Easycomm I/II protocols

Contact Martha at the AMSAT office 301-822-4376 to order.

The complete units will be built in groups, so get your orders in early. Units will be shipped as they become available.

Minimum donations requested for various configurations:

1) Bare board - $20 + S&H – no parts kits available
2) Custom Enclosure powder coat, silk-screened, drilled/punched - $50 + S&H
3) Complete unit - board, serial output, rotor cable, LCD, enclosure - $200 + S&H **our most popular

Documentation for the LVB Tracker can be found at: http://www.LVBTracker.com

Boards and complete units may be ordered from the AMSAT office at 301-822-4376 or from martha@amsat.org

Visit the AMSAT On-Line Store for details on the updated LVB Tracker Box: http://store.amsat.org/catalog

AMSAT Fox-1C $125,000 Launch Initiative Goal ... Your Help is Needed!

AMSAT is excited to announce a launch opportunity for the Fox-1C Cubesat. AMSAT has teamed with Spaceflight for integration and launch utilizing Spaceflight's SHERPA system to a sun-synchronous orbit in the third quarter of 2015.

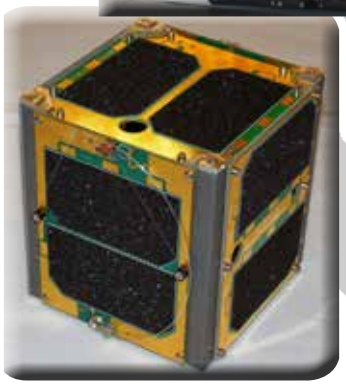
Fox-1C is the third of four Fox-1 series satellites under development, with Fox-1A and RadFXsat/Fox-1B launching through the NASA ELaNa program. Fox-1C will carry an FM repeater system for amateur radio use by radio hams and listeners worldwide. Further details on the satellite and launch will be made available as soon as released.

AMSAT has an immediate need to raise funds to cover both the launch contract and additional materials for construction and testing for Fox-1C. We have set a fundraising goal of $125,000 to cover these expenses over the next 12 months, and allow us to continue to keep amateur radio in space.

Spaceflight's SHERPA will deploy multiple cubesat payloads on-orbit

Spaceflight's SHERPA System

ISIS QuadPack Nanosatellite Dispenser



Your help is needed to get the AMSAT Fox-1C 1U Cubesat launched on the Spaceflight's initial SHERPA flight in 3Q 2015.

For the latest news on Fox-1 watch our website at www.amsat.org, follow us on Twitter at "AMSAT", or on Facebook as "The Radio Amateur Satellite Corporation" for continuing news and opportunities for support.

Donations may be made through the AMSAT webpage at www.amsat.org, by calling (888) 322-6728 or by mail to the AMSAT office at 10605 Concord Street, Kensington, MD 20895, USA. Please consider a recurring, club, or corporate donation to maximize our chance of success with this mission.

AMSAT President's Club
Support Fox-1C ... Join Now!

Contribute to AMSAT directly through easy, automatic charges to your credit card. Since AMSAT is a 501(C)(3) organization donations may be USA tax deductible. (Check with your tax advisor.) To join contact Martha at the AMSAT Office by phone (888) 322-6728 in the US, or (301) 822-4376; e-mail martha@amsat.org.

Titanium Donors contribute at least US $400 per month	❒	$400 / month
	❒	$4800 one time
Platinum Donors contribute at least US $200 per month	❒	$200 / month
	❒	$2400 one time
Gold Donors contribute at least US $100 per month	❒	$100 / month
	❒	$1200 one time
Silver Donors contribute at least US $50 per month	❒	$50 / month
	❒	$600 one time
Bronze Donors contribute at least US $25 per month	❒	$25 / month
	❒	$300 one time
Core Donors contribute at least US $10 per month	❒	$10 / month
	❒	$120 one time

AMSAT and University of Iowa Partner on Scientific Payload for Fox-1D

AMSAT and the University of Iowa have agreed to include the University's HERCI (High Energy Radiation CubeSat Instrument) radiation mapping experiment on Fox-1D. According to Don Kirchner, KDØL, Research Engineer at the University of Iowa, "HERCI is intended to provide a mapping of radiation in a low earth orbit. This is of scientific interest for planning CubeSat test flights for low energy X-Ray detectors."

"The instrument consists of a digital processing unit (DPU) derived from processors currently in orbit around Saturn on Cassini and on the way to Jupiter on the Juno spacecraft," says Kirchner. "The DPU was shrunk to a CubeSat form factor with funding from the Iowa Space Grant Consortium."

The University of Iowa's history in spaceflight research dates back to the earliest satellites. As Kirchner puts it, "HERCI can be considered a direct descendent of the first University of Iowa spaceflight instrument flown on Explorer I in 1958. The instrument is being constructed as a Senior Design Project by four Electrical Engineering students from the UI College of Engineering, under supervision of Space Physics engineering staff from the Department of Physics and Astronomy."

AMSAT's VP of Engineering, Jerry Buxton, NØJY, noted the win-win benefits of the agreement, stating, "This partnership with the University of Iowa illustrates our strategy of leveraging the new CubeSat design to assist universities that need a way to fly scientific payloads while providing a viable ongoing platform for amateur radio."

Fox-1 amateur radio and STEM missions include:

- **Fox-1A** will launch on a NASA ELaNa flight during the 3rd quarter of 2015 from Vandenberg AFB. Science aboard includes a Vanderbilt radiation experiment and Penn State MEMS gyro experiment
- **Fox-1B** will fly with the Vanderbilt University radiation experiments expected in 2016.
- **Fox-1C** will launch on Spaceflight's maiden mission of the SHERPA multi-cubesat deployer during the 3rd quarter of 2015. Science aboard includes a Virginia Tech camera and a Vanderbilt radiation experiment
- **Fox-1D** is a flight spare for Fox-1C. It will include the University of Iowa HERCI experiment. If not needed as a spare it will be submitted in a Cubesat Launch Initiative (CSLI) proposal in 2015.A Virginia Tech camera will be included.

AMSAT-NA Announces Member-Only Special Pricing for M2 Antenna Systems LEO-Pack

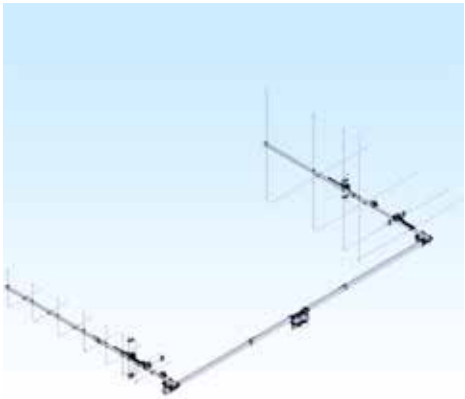


Photo credit: M2 Antenna Systems

M2 Antenna Systems, Inc. of Fresno, CA, introduced the new satellite antenna LEO-Pack using their 436CP16 and 2MCP8A yagis during the 2015 HamCation in Orlando, FL.

The 436CP16 and 2MCP8A are lightweight, circularly polarized antennas optimized for Low Earth Orbit (LEO) Satellite communications or other applications where a small circular polarized antenna is required. Optimum match and gain are designed for the satellite band.

Rear mounting enables easy coaxial cable routing. A preamp (not included) can be mounted close to the antenna for almost no coax loss before the preamp, maximizing your receive performance.

Computer design techniques help keep spurious side lobes down for optimum signal to noise ratios. Both the 436CP16 and 2MCP8A feature the same CNC machined, O-ring and silicone-gel sealed, driven element assemblies common to all M2 Yagi Antennas. This insures years of trouble free performance regardless of weather.

M2 designed a custom LEO cross boom to pair these two antennas together for a very manageable amateur satellite ground station.

AMSAT-NA and M2 Antenna Systems are pleased to announce that the LEO-Pack system is being offered to members only at $499, shipping included (US only). Non-members can join AMSAT-NA at time of purchase to participate in this special purchase. The M2 list price is $545.99.

To place your order, visit the AMSAT store:

http://store.amsat.org/catalog/

M2 Antenna System's LEO-Pack page can be found at:

http://tinyurl.com/nyhgmcr

Paul Stoetzer, N8HM
n8hm@amsat.org

The first couple of months of 2015 were extremely exciting ones for satellite operators. Grid trips, maritime mobile operations, and DX operations were plentiful during this period allowing many active operators to add to their grid and DX totals.

DX Operations

Early 2015 was a fantastic time for anyone looking to add to their DX totals on the satellites. Many DXCC entities rarely heard on the satellites were activated in February 2015.

K1N (Navassa Island) – The highly anticipated DXpedition to Navassa Island, an American possession in the Caribbean Sea, which had not been activated since 1993 and is not expected to be activated again for at least another decade, took place during the first two weeks of February 2015. AMSAT provided a Yaesu FT-817 transceiver, an Arrow antenna, operating instructions, and pass predictions to operate on FO-29 during the expedition. While their operating time on the satellites was limited due to time constraints, they did make 29 QSOs on two passes of FO-29 on the afternoon of February 12th. These were likely the only satellite QSOs made from Navassa Island since the 33 made by the 1978 expedition. The K1N team is preparing a special satellite QSL card for those who were fortunate enough to work them on satellite. Recordings containing many of the QSOs made are available here:

https://soundcloud.com/paul-stoetzer

(note that these recordings are somewhat noisy due to your author's equipment and urban QTH).

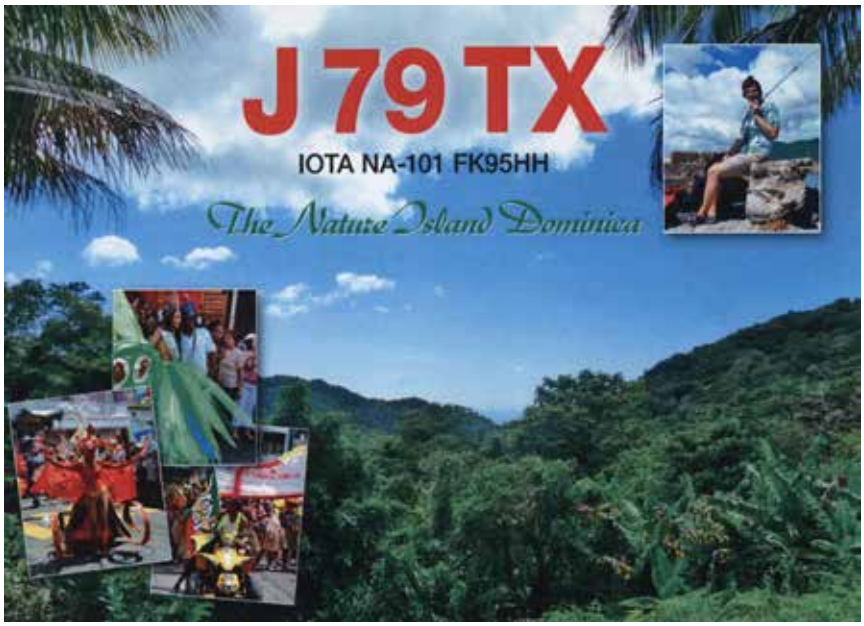
KG4RQ (Guantanamo Bay) – Robert Dye, N4PSK, made several QSOs on SO-50 while he was in Guantanamo Bay for a DXpedition in February with several other operators. This was the first satellite activity from KG4 in several years.

FJ/N2IEN (Saint Barthélemy) – Patrick Dolan, N2IEN, operated several passes of SO-50 from Saint Barthélemy in February 2015. Saint Barthélemy became a separate DXCC entity in 2007 and this may have been the first satellite operation from that DXCC.

PJ7/DL7VTX (Sint Maarten) / J79TX (Dominica) / PJ6/DL7VTX (Saba & Sint Eustatius) / FS/DL7VTX (French St. Martin) – Jens Held, DL7VTX, has been a regular on the FM satellites during his vacations to the Caribbean. This year, he activated PJ7, J7, PJ6, and FS in February and early March on SO-50. Notably, he uses just a Kenwood TH-D7(G) E handheld transceiver and a telescoping whip antenna and does an excellent job with minimal equipment.

MI6GTY (Northern Ireland) – George Mamjis, MI6GTY, has been active on FO-29 from Northern Ireland operating half duplex with a FT-817 and a handheld yagi. With FO-29 near apogee on early morning passes over the Atlantic Ocean, he worked several North American stations from both his home grid of IO64 and the nearby grid of IO74 during the last week of February. Northern Ireland has been very rarely heard on the satellites by stations in North America.

The K1N satellite team working FO-29 on Navassa Island (photo credit W0GJ, K1N co-leader)



DL7VTX's Dominica QSL card

Grid Expeditions

Numerous operators made the effort to put rare or uncommon grids on the air in late December 2014 and the first two months of 2015. Your author activated EN74, EN75, EN84, and EN85 from Northern Michigan in late December and early January. Paulo, PV8DX, activated FJ93 in northern Brazil (and plans to return in the near future). Drew Glasbrenner, KO4MA, and Dave Swanson, KG5CCI, put several uncommon grids on the air during their holiday travels. Dale Pelzer, KL7R, Patrick Stoddard, WD9EWK, Wyatt Dirks, AC0RA, and Carlton Noll, KA4H, among others also activated several rare grids. Andy MacAllister, W5ACM, activated several "wet" grids from a cruise ship in the Gulf of Mexico.

Clayton Coleman, W5PFG, took a trip to Northern Maine to activate several rare grids. He writes:

January 10-11, 2015, I operated from eight different grid squares in the state of Maine. Grid squares FN53-57 and FN65-67 were activated. It was a very fast-paced trip that took us from Sutton, Massachusetts to Caribou, Maine. My purpose for being in New England was business. I flew into Boston, Massachusetts on Friday January 9 and drove to the QTH of Dave, KB1PVH. Dave would be my navigator and guide for the journey up Interstate 95 to the very northernmost grid in Maine. Our first night was spent in Freeport, Maine, home to famous retailer L.L. Bean. Our second night was spent in the town of Presque Isle, Maine. Throughout the trip, I tried to activate as many grid lines as possible. Operating from grid lines makes it feasible for a station to acquire two new grid confirmations from one satellite pass. Fortunately Interstate 95 and its parallel U.S. Route 1 made this possible. During the two-day grid marathon, I utilized AO-7 Mode B, FO-29, SO-50, and AO-73. My equipment on this trip was a Yaesu FT-817, a Yaesu FT-857D, Heil Traveler Headset, and Arrow antenna. All QSO's for this trip have been uploaded to ARRL's Logbook of the World and I have received and responded to numerous paper QSL requests at the time of this writing. Despite January being typically cold, the weather was outstanding and very conducive to a winter roving operation. I would highly recommend this trip to any other would-be adventurers with portable satellite equipment.

UT1FG/MM

January 2015 saw the return to the satellites of Captain Yuri Bodrov, UT1FG/MM. He was first heard heading from Newfoundland to the United Kingdom on board the M/V *Greenwing*. After a couple of port calls in Europe, he headed back through the English Channel in mid-February and traveled through the North Atlantic and Caribbean Sea to the Panama Canal. As of this writing, he is at anchor waiting to enter the Panama Canal. Bodrov operates nearly every satellite pass while he is at sea, even late at night, and is also commonly heard on six meters and HF. Many satellite operators, your author included, sacrificed much sleep to work him in as many new grids as possible during his trip. Upon request, the FUNcube team even commanded AO-73 into full-time transponder mode during the week of February 23rd while he was in range of North America to help satellite operators catch him in as many grids as possible.

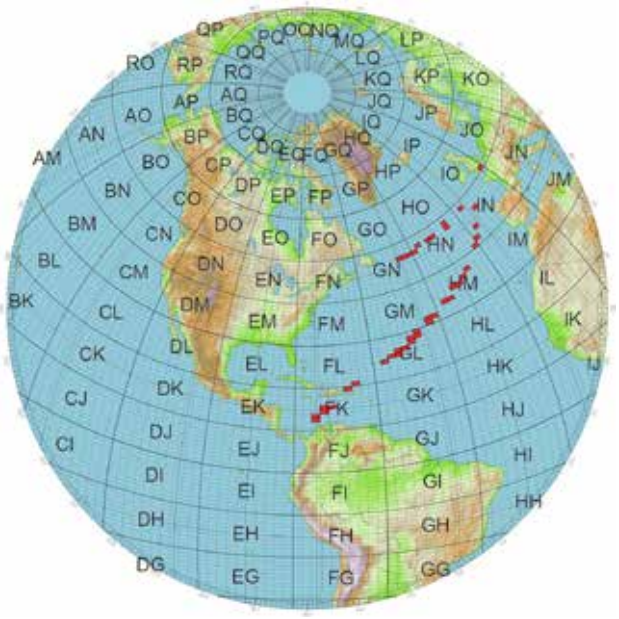
Request for Submissions

This column is meant to be partially supported by reader input. Please send any reports, observations, or photographs for future columns to:

n8hm@amsat.org.

Working AO-73 FUNcube-1 from Augusta, Maine wearing appropriate regional headgear during the AFC Championship that weekend. (FN54) (photo credit W5PFG)

Your author before operating a pass of AO-73 (FUNcube-1) on the EN84/EN85 grid line (the 45th parallel) in Northern Michigan in early January 2015.



A map of QSOs by the author with UT1FG/MM during January and February 2015 (map produced with GCMwin)

Minutes of the 2014 AMSAT-NA Board of Directors Meeting

October 9-10, 2014, Baltimore, MD

The meeting was called to order by AMSAT-NA President Barry Baines, WD4ASW, at 0806 EDT on Thursday, October 9, 2014 in the Frederick Douglas Room.

Members of the Board of Directors present:

- Barry Baines, WD4ASW, President
- Tom Clark, K3IO
- Lou McFadin, W5DID
- Jerry Buxton, N0JY Vice-President for Engineering
- Alan Biddle, WA4SCA, Corporate Secretary
- JoAnne Maenpaa, K9JKM, Vice-President for User Services
- Drew Glasbrenner, KO4MA, Vice-President for Operations, First Alternate

Other officers present:

- Frank Bauer, KA3HDO, Vice-President for Human Space Flight
- Keith Baker, KB1SF/VA3KSF, Treasurer
- EMike McCardel, KC8YLD, Vice-President for Educational Relations
- Patrick Stoddard, WD9EWK, Director of Field Operations
- Martha Saragovitz, Manager

Among the AMSAT-NA members participating and/or observing during the Board meeting were:

- Bill Tynan, W3XO
- Dan Schultz, N8FGV
- Dave Taylor, W8AAS
- Hector L. Martinez, CO6CBF/W5CBF
- Jennifer Rojowski, N8GZL
- Joe Fitzgerald, KM1P
- Keith Pugh, W5IU
- Nick Pugh, K5QXJ
- Perry Klein, W3PK
- Pat Kilroy, N8PK
- Paul Stoetzer, N8HM
- Phil Karn, KA9Q
- Ray Hoad, WA5QGD
- Kira Gantt
- Zach Leffke, KJ4QLP
- Clayton Coleman, W5PFG
- Jim Hain, W2IMY

Barry opened by welcoming the Board members, officers, and visitors. He introduced the newly elected Board members and welcomed JoAnne, K9JKM as the new Vice-President for User Services. He explained that she would gradually assuming her new duties while be continuing as editor of the *AMSAT Journal* until a replacement is found. He then presented the slate of AMSAT-NA Officers for approval by the Board:

- President, Barry Baines, WD4ASW
- Vice-President for Operations, Drew Glasbrenner, KO4MA
- Vice-President for User Services, JoAnne Maenpaa, K9JKM
- Vice-President for Engineering, Jerry Buxton, N0JY
- Vice-President for Human Spaceflight, Frank Bauer, KA3HDO
- Vice-President for Educational Relations, EMike McCardel, KC8YLD
- Corporate Secretary, Alan Biddle, WA4SCA
- Treasurer, Keith Baker, KB1SF/VA3KSF
- Manager, Martha Saragovitz

The confirmation of the slate of Officers was moved by Alan, seconded by Barry, and approved by the unanimous consent of the Board. The following Officer positions are currently open:

- Executive Vice-President
- Vice-President, Marketing

After the vote, Barry added that in addition to the open positions, there are positions which will become vacant in the near future, and that AMSAT-NA needs to plan for succession to insure continuity. Tom mentioned that the Executive Vice-President Positon is a particularly important one to be filled.

Executive and Other Team Reports

President's report by Barry Baines, WD4ASW

Barry reviewed the primary issues to be presented to the members at the General Meeting. (The full presentation was broadcast via EchoLink and will be available on the AMSAT YouTube channel.) These included Officers and team leaders, the recent AMSAT office move, upcoming launches, ARISS program changes, educational outreach, the transition from International Traffic in Arms Regulations (ITAR) to Export Administration Regulations (EAR), issues of licensing cubesats and recent joint contacts by AMSAT and the ARRL with the FCC, events in AMSAT-IT, the continuing slow membership decline, funding issues including the Fox-1C satellite, and tentative plans for the next series of Fox-2 satellites.

Dave Taylor, W8AAS asked for clarification on the effects of the transition from ITAR to EAR. Barry explained that it was not possible to determine this until the final rules are released in November and the implications analyzed and understood.

Martha and Barry reviewed changes and concerns for the AMSAT office. The first move by AMSAT in 30 years was carried out with the help of AMSAT members. In particular, Bob McGwier, N4HY contributed to the transporting and storage of AMSAT's archives. The new facilities are safer and in much better repair than the old Silver Spring office, though somewhat smaller. The software in use is being updated to newer versions. Unfortunately, volunteer support is slowly becoming less available, and new support needs to be found. Finally, she touched on issues with the IRS which required some time to resolve, and temporarily impacted fund raising for Fox-1C.

Secretary's report by Alan Biddle, WA4SCA

Alan reported that there have been 5 formal Board meetings held by telecon this year. The minutes of three have been approved and published in the *AMSAT Journal*. He requested approval of the two formal Board meetings held by telecon on 17 June and 1 July 2014. The purpose of the first was to authorize Drew as Vice-President for Operations to negotiate with Spaceflight, Inc. for the commercial launch of a Fox-1 series cubesat. The second meeting authorized the change to AMSAT's accounting procedures from yearly to biannually, the approval of earlier minutes, and additional issues involving the Spaceflight, Inc. negotiations. It was moved by Barry, seconded by Tom, and approved unanimously with Jerry abstaining that: "The minutes of both meetings be approved as submitted." Alan explained that since these minutes include issues both of a confidential nature to AMSAT, and covered by the non-disclosure agreement with Spaceflight, Inc. they will not be published at this time.

He then discussed the 2014 Board of Directors election. Due to an error on the part of our printer the return envelopes had the old office address. Because this was made known to the members upon discovery, the Post Office was continuing to forward the mail, and a final check at the old post office was made, all ballots submitted were counted. Approximately 22% of the ballots were returned, which while not as high as is desired, is consistent with recent years.

At the 2013 Board meeting, a secondary AMSAT logo was approved, to be used along with the traditional one which serves as the basis of logos used by AMSAT organizations around the world. Shortly before the meeting we received news from the attorney who handles our trademark affairs that the new logo has been recognized.

Alan finished by mentioning that both of the GoToMeeting accounts continue to be extensively used by a variety of groups. Having a second account, used primarily by the engineering group, has resulted in substantial savings in travel and related costs. We plan to continue both accounts indefinitely.

Open Treasurer's Report by Keith Baker, KB1SF/VA3KSF

Keith began by reviewing the type of audits conducted by Berlin, Ramos, and recent changes to procedures required by the Dodd-Frank Act. These have raised the cost of compliance, both as to accounting fees as well as the amount of time spent gathering information. As a result, AMSAT will be doing biennial rather than annual reviews, which is consistent with the recommended practices for similar organizations. He also discussed the need to account for time contributed by members, and the shortcomings of the old system.

He then moved on to the issue of revenue for AMSAT's continued operation. While it is solvent in the short term, it is no longer able to support daily operations purely from membership dues. Membership numbers continue to fall. This is in

part due to current generations not being joiners as in the past, and is afflicting other similar organizations. While some renewed interest and membership is expected with the launch of multiple Fox-1 satellites next year, he emphasized that finding new revenue streams is not optional if AMSAT is to continue in the long term. While AMSAT has benefited significantly from the appreciation of the investing climate, history has shown that this cannot be expected to continue indefinitely.

Keith finished his report by discussing the firms used over the past few years to manage AMSAT's portfolio. The recent move to Merrill Lynch has resulted in somewhat lower management fees with more responsiveness on the part of the account manager.

In the following discussions, there were various questions and suggestions about improving AMSAT's financial situation. On the revenue side, Martha mentioned we have not been able to attract a significant number of generous contributors which most organizations need. Jerry suggested a membership contest, and Lou reminded the Board that the Vice-President for Marketing position has been vacant for years and needs to be filled with an energetic person with the right background and skills. Drew suggested a further review, including office operations, to identify areas where costs might be reduced.

Finally, it was moved by Tom, seconded by Jerry, that Berlin, Ramos be retained as our accounting firm for the next year. The motion was approved unanimously.

Satellite Operations Report by Drew Glasbrenner, KO4MA

Drew reported on the current state of existing satellites. AO-7, approaching its 40th anniversary, continues to be used due to its wide coverage. FO-29, especially after the loss of VO-52 continues to be popular, but is nearing 20 years of service. The only functioning FM satellite, SO-50, is in heavy use despite its low output power and one or more replacements are badly needed. AO-73 has attracted many users despite its relatively limited availability for amateur use. He added that UKube-1, EO-79 and EO-80 will have capabilities of interest to amateurs, but have not been released for amateur use. The status of Triton-1 and Unisat-6 is not currently known.

Drew moved on to the issue of expanding AMSAT's use of social media such as Twitter, Google+, YouTube and Facebook. He reported that followers of these AMSAT-NA accounts are increasing rapidly, and exceed those using the older communication outlets. Jerry commented that these are in turn picked up quickly by other amateur news services. Drew also touched on the related issue of crowdfunding such as the current FundRazr effort to pay for the Fox-1C launch. He emphasized that in order to be successful, it is important that meaningful perks be available to the donors. He ended by saying that the "maker culture" has much in common with ours and needs a meaningful outreach effort.

AMSAT-NA Facilities Report by Lou McFadin, W5DID

Lou reported on the AMSAT-NA facilities in Central Florida. The facility, suitable for storage as well as development and testing, is air conditioned and secure. The thermal vacuum test equipment operation has been upgraded with a hot-and-cold-plate needed to cycle the temperature in component testing. He is looking for someone to undertake automation of this function to allow more precise testing with lower workload.

User Services Team Report by Members of the AMSAT-NA Leadership Team

AMSAT-NA Journal and AMSAT-NA News Service by JoAnne Maenpaa, K9JKM

JoAnne began by reviewing the staff and functions of the AMSAT-NA User Services. These currently consist of *AMSAT Journal*, News Service, Publications, Electronic Services, Field Operations, and the Dayton Hamvention. She explained that while she will be assuming the duties of Vice-President for User Services over the next few months, the *AMSAT Journal* still consumes the majority of her time. While the process of generating 6 issues per hear is fairly routine, it still requires a constant search for new articles. She is still looking for someone to assume the primary editor duties.

The changing purpose of the *Journal* was addressed. In light of the rapidly expanding new media where information is often released in minutes, it is becoming more a source of reference and in-depth articles rather than breaking news. Martha expressed concern that most of the pictures used in the Journal had already been seen elsewhere, with Drew and Patrick both emphasizing that was necessary to get information out in what is now considered a timely fashion. Tom mentioned that the proofs sent internally which have color pictures are more effective. Barry commented that we need to match carefully a report or article to the most appropriate media. JoAnne underlined the need for the various department heads providing articles as appropriate about their activities. She gave the example of Fox needing progress articles and information leading up to its launch next year.

JoAnne commented that the AMSAT News Service continues to be the official voice of AMSAT for breaking stories with other news service look to it for verification. Keith Pugh, W5IU mentioned that the growing length and number of stories, combined with contesting and other issues on 20 meters, is complicating its transmission over the existing HF nets. He suggested that a move to non-HF operations such as repeaters, EchoLink, and perhaps podcast should be considered. It was reported that the weekly Houston repeater and EchoLink net was working well with good turnout. She finished by discussing the new *AMSAT Journal* and other historical publications now available through the AMSAT Store. This is a valuable resource compiled from both AMSAT and individual resources which will be updated regularly. Drew suggested that we consider making it available by direct download from the AMSAT Store.

Field Operations by Patrick Stoddard, WD9EWK

Patrick discussed the activities of Field Operations over the past year. There has been representation at 28 different events. There are currently 82 Area Coordinators, with approximately 25 in regular contact. He mentioned he is considering having Area Coordinators reapply to insure all those listed are still actively involved. One of the factors in the loss of Coordinators is that those who became active when high earth orbit satellites were the norm are not as invested in the current low earth orbit missions. Patrick reported there is an events section on the web site, but that there is a need for a method to maintain close contact, such as the closed session on the old web site. Tom mentioned that a monthly telecon might fill this need.

Dayton 2014 report by Steve Belter, N9IP

Steve Belter, N9IP was unable to attend the Board Meeting. Alan Biddle, WA4SCA, presented his report:

This was our second year without the active direction of Gould Smith, WA4SXM. People are adapting, and this year we had 52 volunteers which is possibly a record. Everybody enjoyed the opportunity to participate. There were several adjustments for 2014. The new "Beginner's Corner," staffed by highly experienced operators, was a popular place for new and potential members and operators to ask questions without impeding the other booth activities. We also made a concerted effort to recruit new members, primarily through the basic step of asking interested people to join or renew. This simple step was very effective and will be further developed next year. The basic layout of the booth proved to be functional, and the modest expenditure for carpeting to join both sides of the aisle resulted in an eye-catching, professional presentation. People were more likely to browse both sides. Demand for AMSAT books and equipment was unusually high this year, with several items sold out by early Saturday afternoon. The AMSAT Forum continues to draw well, and the presentations are being recorded and placed on the AMSAT YouTube channel.

For 2015 we plan to continue making improvements. Most importantly, we will need to insure adequate inventory. Gould's book, *Getting Started in Satellites* continues to be popular. Due to the rapid pace of satellite launches, and the short lifetime of many, we will gradually transition toward an operating reference including a few specific, major satellites such as the Fox series. Finally, we need to make available electronic processing of credit cards for ease of use and security since that service is now readily available

Amateur Radio on the International Space Station

ARISS-International report by Dave Taylor, W8AAS

Dave, AMSAT-NA's U.S. delegate to the ARISS-International working group, covered the highlights of the past year's ARISS operations. He began with the April 2014 meeting at the European Space Research and Technology Centre (ESTEC) in the Netherlands. All 5 regions were represented. The primary theme was to improve international cooperation while enhancing enthusiasm. He reported 72 school contacts in 21 countries with the International Space Station with great interest from the schools and other groups, and that the US contact proposal process is now being streamlined.

He finished with a review of changes in equipment in use. School contacts have been somewhat more challenging due to the switch to the Ericsson VHF HT with somewhat lower available power. Both the TM-D700s are no longer in service, and the TM-D710 in the Russian section is not programmed. He also discussed briefly the commissioning of the new Ham TV system, which is currently sending blank test transmissions.

ARISS-US by Frank Bauer, KA3HDO

Frank began by discussing the organization of ARISS-US which is sponsored by AMSAT, ARRL, and NASA. He reported there have been significant changes in NASA's partnership with ARISS, including funding. NASA's Office of Education lost significant funding, including funding for ARISS. At one point this loss of funding would have resulted in the termination of ARISS operations. However, due to the hard work and good will of those involved, relationships now exist or are being developed with NASA's Spacecraft Communications and Navigation (SCaN) program and the Center for the Advancement of Science in Space (CASIS). As a result, ARISS educational activities and contacts have continued without interruption. Since ARISS will no longer be funded entirely by NASA, it is necessary for ARISS to develop and mature in-kind and real dollar funding sources to sustain the program. As an example, he mentioned that certifying a new TM-710 for the Columbus module will require testing and documentation estimated to cost $100k. He finished by reviewing the new, streamlined process for school contact requests.

For more details on the numerous changes that have occurred this past year on ARISS, please see "ARISS 2014: A Program in Transition." by Frank H. Bauer KA3HDO, Gaston Bertels ON4WF, Debra Johnson K1DMJ, E. Mike McCardel KC8YLD, Lou McFadin W5DID, Mark Steiner K3MS, Dave Taylor W8AAS, Stefan Wagener VE4NSA, and Rosalie White K1STO in the Proceedings of the 32nd Space Symposium and Annual Meeting.

ARISS Hardware by Frank Bauer, KA3HDO and Lou McFadin, W5DID

Lou gave the Board an overview of the history of the AMSAT-Italia Digital Amateur Television (DATV), sometimes called "Ham Video" now installed in the Columbus module. This included the technical issues requiring the use of digital rather than analog systems. He reviewed the development process for the equipment and the current state of testing. Frank explained that there were several 2.4 GHz downlinks being tested and evaluated due to concerns with Wi-Fi and other terrestrial sources. They reported that initial testing is going well.

For more details, please see "Ham TV History, Status, and Upcoming Projects", by Gaston Bertels ON4WF, Lou McFadin W5DID, and Mark Steiner K3MS in the Proceedings of the 32nd Space Symposium and Annual Meeting.

Virginia Tech Collaborative Educational Outreach Program by Dr. Kira Gantt, Education Director at the Hume Center, and Zach Leffke, KJ4QLP

Kira discussed the Virginia Tech efforts to develop sustainable K-12 educational outreach programs to communities which have been traditionally underserved. Their effort is to tie space research and activities to the state of Virginia's educational standards. She emphasized that this integration was necessary for acceptance. To insure this, the curriculum is being developed by teachers with both science and amateur radio backgrounds. She mentioned a new satellite ground station which students are constructing. Keith Pugh, W5IU mentioned that there were several basic lesson plans available from the ARRL which could be adapted.

Educational Outreach by EMike McCardel, KC8YLD

EMike reviewed his work as AMSAT's Vice-President for Educational Relations over the past year. For the most part, it involved building relationships, outreach to assist others with the ultimate purpose of keeping amateur radio in space, and, to a lesser extent, coordinating among efforts from within AMSAT. He mentioned that his outreach included many traditional groups such as the ARRL, Virginia Tech's Hume Center, and NASA, but also unconventional groups such as the Star Trek Science Club.

He moved on to the various events where he gave presentations. The principle ones were at the annual Dayton Hamvention, the ISS Research and Development Conference, and the ARRL Centennial. Each provided an opportunity to interact with and develop working relations with various groups with common educational interests. EMike emphasized that, while there is a formal Educational Outreach department in AMSAT, Engineering, User Services, and Human Spaceflight are all deeply involved, and necessary for its success.

EMike finished by explaining that the next year will be spent deepening and expanding relationships already existing and looking for new ones. He emphasized that a key requirement to do this successfully will be recruiting additional people to assist with Educational Relation activities.

For information on AMSAT's long history of involvement in education, please see: "OLD SCHOOL! A Backward Glance at AMSAT's Education and Its Continued Relevance", by E. Michael McCardel, KC8YLD in the Proceedings of the 31st Space Symposium and Annual Meeting.

ITAR Related Protocols by Dr. Kira Gantt and Zach Leffke, KJ4QLP

Kira and Zack reviewed the Virginia Tech-Hume Center programs, and their need to comply with ITAR and now the EAR regulations. Kira reported that VT Office of Export and Secure Research Compliance (OESRC) has dedicated personnel and resources. She also asked if a formal relationship could be developed which could be of use to AMSAT. Barry suggested a visit to VT should be made, and finished with a discussion of issues from his interactions with Bureau of Industry and Security (BIS).

AMSAT'S Store, Website, and Electronic Service by Joe Fitzgerald, KM1P; JoAnne Maenpaa, K9JKM and Alan Biddle, WA4SCA

JoAnne began with a brief presentation of the various components of AMSAT's electronic services. The move to the new server, directed by Joe, is complete, and all services are running well, though any active system is always a work in progress. She reviewed a series of planned or possible enhancements including features and logins for members, close integration with various social media, and improved contact information. She observed that while the mailing list system is fairly old, it continues to serve not only AMSAT-NA but other national AMSAT organizations as well as the de facto primary hub of information release and exchange. Many radio amateurs first learn about AMSAT here and move on to become members. Events have shown, however, that it does occasionally need some moderation. Drew emphasized that we need to get information out quickly since the old process is no longer adequate.

Alan moved on to the AMSAT Store. It continues to work as needed, but is not as user friendly as might be desired when it comes to presenting the sales information for processing. Martha has compensated for this with her usual professionalism. There have also been some issues with PayPal which handles all our payment processing. Due to different national legal requirements and policies, some of our customers have had issues with purchases requiring additional steps for validation. While they constitute a small fraction of our sales, it is an ongoing source of annoyance. He suggested that

we need a "storemaster," someone familiar with the software used, who has the necessary time and skill to improve the shopping experience.

Alan moved on to the issue of content for the AMSAT.ORG site. He reported great strides in the past year to creating reference content. The problem of obsolescent content is being addressed by removing old pages and replacing them with updated versions as they are identified. Several of the various AMSAT departments are internalizing the need to proactively provide content. As people become more used to this, and the ease of using the site features, information is becoming available in a more timely fashion without the need to intermediate editing.

Joe discussed some of the various technical issues which have surfaced since the move from the UCSD server. There have been a few cases, most involving spam and other mail services, where they handled issues which he must now handle directly. In particular, some of the major e-mail providers require significant documentation to permit mail from other domains. Perry Klein, W3PK asked about whether the spam filtering could be improved. Joe explained that approximately 100,000 pieces of spam are stopped weekly, and that a further tightening of the filters risked the loss of valid e-mail. Alan mentioned that he had found using a separate address for non-trusted services greatly reduced the amount of spam delivered to his working accounts.

AMSAT Directory by Perry Klein, W3PK

Perry discussed the AMSAT Directory, usually issued yearly or as revisions are needed as a PDF. He is considering making it available electronically as v-Cards which can be imported to most e-mail programs, and wanted input on the information needed to be carried over, and also issues of confidentiality.

AMSAT Engineering by Jerry Buxton, N0JY

Jerry reviewed the Fox project transition process since the loss of Tony Monteiro, AA2TX earlier this year. He reported that the launch provider had slipped the launch date but not the satellite delivery date, and introduced a requirement for a helium purge which has significant implications for the Penn State gyro experiment. He explained that delays in delivery of the Virginia Tech camera experiment was useful in NASA requesting adjustment of the delivery date. This is a benefit for several of the other payloads. He finished by reviewing the remainder of the schedule for Fox-1A to be delivered in March 2015.

Jerry then discussed Fox-1B, accepted, not manifested but with a very tentative July 2016 launch date, and Fox-1C which is being launched in the third quarter of 2015 under contract with Spaceflight, Inc. Fox-1D will be a flight spare, but available for a later opportunity. He reported that he had been contacted by other universities interested in pairing with AMSAT.

Jerry transitioned to a discussion of the upcoming Fox-2 series. He explained that people often contributed to a particular satellite or component, but do not necessarily sign on indefinitely. As a result, we need a steady supply of fresh contributors, but also a core group who will stay the course and provide support throughout the lifetime of existing satellites. The latter is needed for continuity, and will become critically important as we move toward more sophisticated spacecraft. He remarked that one can think of Fox-1 as a Novice License before going on to more advanced projects. The next generation will involve much more demanding requirements for power, antennas, and pointing systems. Because of this, we need to examine proposals carefully, and insure that we speak with a unified voice when contacting launch providers and other institutions.

After the break, Jerry discussed the path by which we will proceed. He explained that AMSAT needs to work on various proposals through June 2015, to be approved at the next Board meeting. Based on past experiences with AMSAT and other group's projects, a realistic time frame would be approximately 42 months for a new LEO mission, and 58 months for GTO/HEO projects. Barry asked about continuing with the Fox-1 series. Jerry replied that while it was possible, some of the components used are already becoming scarce, requiring redesign resources which are needed for the future satellites. Tom reminded the group that the old microsats were done on a much shorter time scale, and that he thought Jerry's timetable was excessively conservative. He emphasized that modern communications, and what has been called virtual teamwork could shorten this significantly. Barry pointed out that there have been significant changes since the microsats were developed. The financial and regulatory environments are much more restrictive, and personnel resources are not as available or strategically placed. He finished by emphasizing that there would be no preconceived notions.

CubeSat Proposal for HEO by Bill Tynan, W3XO; Dan Shultz, N8FGV; Jan King, W3GEY; Phil Karn, KA9Q; and Tom Clark, K3IO

Bill began with an introduction to an innovative AMSAT response to NASA's interest in receiving proposals for a six unit (6U) CubeSat project to be deployed to either a geosynchronous transfer orbit (GTO) or directly to a Molniya such as used by Oscar 10, 13, and 40. He explained that it would be advantageous to submit a proposal by the November 2014 deadline since there is a significant lead time involved and launch slots are expected to fill rapidly. Nick Pugh, K5QXJ said that a HEO satellite is needed to reignite the AMSAT membership, while Dan said that anything innovative in orbit would be adequate to satisfy both members and launch providers.

Jan began the presentation by explaining the motivations for submitting a proposal quickly, and that his presentation was the result of a two week effort to answer the question: "Could a 6U sized spacecraft, carrying an amateur payload and launched into a GTO orbit, have a performance as good as the AO-13 UHF-to-VHF transponder?" The presentation contained a significant amount of technical discussion of the various technologies needed to answer the question in the affirmative. The driving technologies involved deployable solar arrays, precision three axis attitude control, 10 GHz and 24 GHz RF systems (since traditional VHF and UHF frequencies are impractical) and, as traditional analog technologies are inadequate to provide the required performance, adequate computer processing power to enable digital signal processing. Phil volunteered that adequate computing power required modest advances in the state of the art and could be a significant limitation. Jan then mentioned other contacts, including research institutions, who had expressed interest in the project. He finished by stating that the HEO Group has sufficient resource to complete the proposal on time without drawing extensively on other committed AMSAT resources.

There were several questions about various aspects of the project. Drew expressed the concern that no existing amateur ground stations would meet the minimum equipment requirements and would require a significant expenditure on new equipment. He suggested that they should consider including a more traditional VHF-UHF transponder for the low and intermediate part of the orbit with the proposed microwave transponder used near apogee. This would allow significantly better communication range for those using existing equipment while allowing adequate scope for technical experimentation and innovation.

The meeting then moved to a closed session to discuss financial and other confidential matters. It was adjourned for the night at 2155 EDT.

The meeting was resumed October 10th, at 0805 EDT to continue various issues including those covered by non-disclosure agreements. At 1100 EDT, the Board meeting returned to open status.

FCC Debris Mitigation by Perry Klein, W3PK

Perry explained that, approximately 10 years ago, AMSAT made a filing to the effect that the FCC should not be involved in debris mitigation, as this was more properly handled by other government agencies. He explained that the FCC is proposing to simplify the process, limiting it to commercial launches, and, in light of the changing events and delay, wanted to know whether AMSAT wished to keep the petition active. Barry asked about the impact of keeping the filing active since much of the issue is now covered by Treaty obligations. It was the sense of the Board that the filing be allowed to go forward.

Final budget discussion by Keith Baker, KB1SF/VA3KSF

Most of the budget issue were discussed in the closed session. Keith reported that the only significant issue involved moving Fox-1C

funding forward from 2015 to the current year. Since some budget items are still not available, a formal meeting will be scheduled at a later date.

AMSAT-NA 2015 Symposium Planning by Barry Baines, WD4ASW

Barry reported that suggestions are being solicited for the 2015 Symposium but that nothing has been received to date. It remarked that while there have been suggestions to consider biennial meetings that the Bylaws require them to be held annually. Lou mentioned that while much of the load falls to the hosting group that AMSAT-NA has an experienced core for basic guidance. It was suggested that we should consider venues other than traditional convention hotels. However, these are becoming more difficult to access, and transportation logistic between motels and the facilities is a concern.

Special commendations and recognitions by Tom Clark, K3IO

The loss of Tony Monteiro, AA2TX and condolences to his family.

Recognition and best wishes to Gould Smith, WA4SXM, Bob McGwier, N4HY, Bill Hook, W3QBC, and Phil Karn, KA9Q who are experiencing significant health issues.

The following people were recognized for their particular contributions to AMSAT-NA and its mission over the past year by various members of the Board and other officers:

- Jan King, W3GEY for his many contributions to AMSAT and being the speaker at the Symposium Banquet.
- Col. Charles E. McGee, USAF (Ret) Tuskegee Airman for his contributions to our country and his inspiring presentation.
- Wayne Estes, W9AE for his technical support of the popular SatPC32 tracking program.
- Bob McGwier, N4HY and Sharon McGwier, N1SMM, Frank Bauer, KA3HDO, John Shew, N4QQ, Tom Clark, K3IO, Fay Symons, and of course Martha Saragovitz for moving the AMSAT office.
- Mike Jones, W6GCY for his contributions to maintaining the satellite content pages.
- Drew Glasbrenner, KO4MA for his work in creating the popular Fox challenge coins.
- Bill Tynan, W3XO; Dan Shultz, N8FGV; Jan King, W3GEY; Phil Karn, KA9Q; and Tom Clark, K3IO; and Nick Pugh, K5QXJ for their innovative HEO proposal.
- The entire Fox-1 engineering team for making it a reality.
- Mark Kanawati, N4TPY at SpaceQuest for assistance in acquiring solar cells for Fox.
- Scott Higgenbotham at NASA for his help in scheduling Fox delivery.
- Burns Fisher, Jr. W2BFJ, and Joe Fitzgerald KM1P for their liaison with Tony, AA2TX and his family.
- Steve Coy, K8UD for his valuable help serving on the AMSAT Board.
- Ron Parise's widow for her donation of equipment to be auctioned.
- Veronica Monteiro for graciously providing the voice identifications to be used on Fox.
- Mary Lou Monteiro for her help in transferring equipment and information to the engineering team.

There being no further business, it was move by Barry, seconded by Jerry, and unanimously approved by the Board, that the meeting be adjourned at 1149 EDT.

Respectfully Submitted,
Alan Biddle, WA4SCA
Corporate Secretary

AMSAT Fox-1 Challenge Coin Available for Donations at $100 or Higher

Donations may be made via the:

- AMSAT website at **http://www.amsat.org**
- FundRazr crowdsourcing app at: **http://fnd.us/c/6pz92**
- AMSAT office at (888) 322-6728

AMSAT is Amateur Radio in Space
... and YOU are AMSAT

Here are opportunities to launch your amateur radio experience to new heights ...

ARISS Development and Support

AMSAT's Human Space Flight Team is looking for volunteers to help with development and support of the ARISS program:

- Mentors for school contacts
- Support for the ARISS web
- Hardware development for spaceflight and ground stations
- Help with QSL and awards certificate mailing

To volunteer send an e-mail describing your area of expertise to Frank Bauer at: ka3hdo@amsat.org.

AMSAT Internet Presence

AMSAT's information technology team has immediate needs for volunteers to help with development and on-going support of our internet presence:

- Satellite status updating and reporting
- Add/delete satellites to ANS and the web as needed
- Research and report satellite details including frequencies, beacons, operating modes
- Manage AMSAT's Facebook and Twitter presence

To volunteer send an e-mail to Drew Glasbrenner, KO4MA at: ko4ma@amsat.org.

AMSAT's web presence needs site content authors for content development for technical articles and feature development.

To volunteer send an e-mail to JoAnne Maenpaa, K9JKM at: k9jkm@amsat.org.

AMSAT Engineering Team

AMSAT Engineering is looking for hams interested in developing ground station equipment for future satellites. An inexpensive L-Band uplink converter is something that is of interest right now for LEO satellites as part of the recently approved technology funding.

If you are interested in helping, please contact AMSAT Engineering by completing the form on the website to tell Jerry Buxton, N0JY, the Vice President of Engineering, how you can volunteer your time and skills to help AMSAT engineering build satellites and other required hardware/software:

http://ww2.amsat.org/?page_id=1121

Please remember to include your AMSAT membership number.

AMSAT User Services

AMSAT is looking for an on-line store co-manager. Your efforts will involve updating and refreshing the osCommerce based AMSAT Store web page when new merchandise becomes available or prices and shipping costs change. Shipping and credit card charges are handled by the AMSAT Office.

- Add new merchandise offerings
- Delete merchandise no longer available
- Update shipping costs as needed
- Add periodic updates for registrations for Dayton and the Symposium
- Interface with the AMSAT Office

To volunteer send an e-mail to JoAnne Maenpaa, K9JKM at: k9jkm@amsat.org.

AMSAT Educational Relations Team

AMSAT's Educational Relations Team needs volunteers with a background in education and classroom lesson development ...

- Engage the educational community through presentations of how we can assist teaching about space in the classroom
- Create scientific and engineering experiments packaged for the classroom
- Create methods to display and analyze experimental data received from Fox-1

To volunteer send an e-mail describing your area of expertise to E. Mike McCardel, KC8YLD at: kc8yld@amsat.org.

AMSAT Field Operations

AMSAT's Field Operations Team is looking for satellite operators to promote amateur radio in space with hands-on demonstrations and presentations.

- Promote AMSAT at hamfests
- Setup and operate satellite demonstrations at hamfests
- Provide presentations at club meetings
- Show amateur radio in space at Dayton, Pacificon, Orlando Hamcation

To volunteer send an e-mail to Patrick Stoddard, WD9EWK at: wd9ewk@amsat.org.

You can find more information on the web ...
www.amsat.org ... click AMSAT ... then click Volunteer