

Big Island Amateur Radio Club Newsletter

September 2019

Next BIARC
meeting is at 2
p.m. Saturday,
Sept. 14, at Keauu
Community
Center.

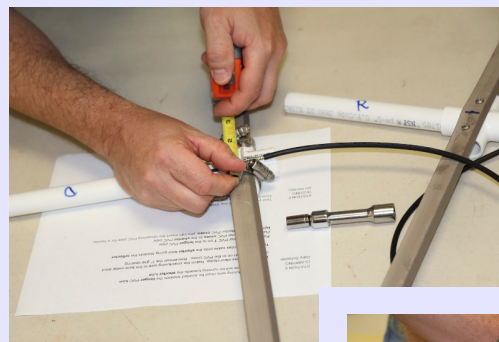


Gary Schwiter, at left, and Mel Uchida assemble one of the directional yagi antennas.

Club members enjoy antenna- build party at August meeting

The program for the August meeting was coordinated by Mel Uchida, KH6EKD.

He and his crew supervised a "tape-measure antenna-build" party.



Photos
by
Gary
Miller,
KK6GM

Continued on next page

From previous page



... The great antenna build, continued



The President's Corner

Honolulu, we have a problem

Recently, several amateur radio clubs in Hawaii were contacted by individuals from the Hawaii Space Flight Laboratory at the University of Hawaii, Manoa.

These individuals were seeking the amateur radio community's support of their program's intended use of the amateur radio bands, for their NEUTRON-1 satellite project. The email that the BIARC board received was published in last month's newsletter.

As I detailed at the July Membership meeting, the BIARC board voted on whether to sign their pre-written letter of support. Due to concerns I'll summarize here, the board did sign that letter.

Several concerns were raised about the request. I communicated these concerns to Joe Speroni (AH0A) ARRL Section Manager for the Pacific Section. It was Joe who discovered that several other clubs had been sent similar requests to the one we received. Joe escalated our concerns to the ARRL headquarters.

The ARRL asked that I engage the HSFL to investigate the matter, in my role of ARRL Assistant Section Manager. Below is a summary of the concerns discussed, how some of those concerns have been addressed, and where we stand in the ongoing process to seek resolution to the remaining concerns.

On interference:

The scope detailed in the original request from the HSFL team was not accurate. The inaccuracies contained in their request certainly led to a strong initial reaction from some of us. Namely, the bandwidths they were seeking to use were exorbitant, to say the least. The details of their requested use of the spectrum were ambiguous at best.

The strictest interpretation of the email to BIARC suggested that the request was to use 10MHz of spectrum in the 2 meter band for an uplink. This is surprising, as the allocation to



NH6ET

the Amateur Radio Service in the 2m band is only 4MHz wide! If the use of 10MHz of spectrum was accurate, their use would not only potentially interfere with the Amateur Radio Service, but other radio services as well. They also stated intent to use another 10MHz of spectrum, but in the 70 centimeter band, for the downlink. Their Satellite is to fly alongside the International Space Station. They will be communicating with it while the ISS is in view of Hawaii.

Essentially, the way their request was written, we were being asked to GIVE UP THE ENTIRE 2 METER BAND for the duration of every ISS overflight. Similarly, we were being asked to GIVE UP THE MAJORITY OF THE 70 CENTIMETER BAND for the duration of every ISS overflight. Further, WE ARE BEING ASKED TO POTENTIALLY GIVE UP the high speed data portion of the 13 centimeter band for the duration of every ISS overflight.

As you can see, I have written two of the three primary interference concerns in the past tense. As I said, their email did not match their actual scope. Through my first few conversations with members of their team, I came to understand their scope to be:

VHF uplink (2 meter amateur band.)

- AFSK modulated signal.
- Channel center of 146.000. Though they have signaled willingness to move this to the OSCAR portion of the band.
- 10KHz of modulated bandwidth, plus guard bandwidth, so a 12.5KHz channel width.
- Communications intended to be conducted using the AX.25 protocol UHF downlink (70 centimeter band.)
- GFSK modulated signal.
- Channel center of 437.270MHz.
- 20KHz of modulated bandwidth, plus guard bandwidth, so a 25KHz channel width.
- Communications intended to be conducted using the AX.25 protocol S-Band up/downlink (13 centimeter amateur band.)
- An OFDM QPSK modulated signal.
- Channel center of 2.430GHz.
- 20MHz of modulated bandwidth.
- Communications intended to be conducted using a proprietary protocol.

Even after the scope was better understood, one glaring potential for interference exists, and is as of yet unresolved. The potential for interference in the 13cm band remains unchanged. Interference with and from a space station

Continued on next page

From previous page

is certainly possible. Amateur Radio operators on Kauai are probably at the greatest risk for interference, as the ground station is located at Kauai Community College in Puihi.

The high speed data links commonly deployed in the 2.4GHz band, which we know as our 13cm band, typically use very high gain antennas. These antennas usually point at the horizon. What is beyond the top half of that horizon is space. That signal is beamed at relatively high EIRP, and reciprocally with high receive gain, right through the orbit of the intended space station. It is conceivable that amateur radio data links may interfere with the space station. The space station could also interfere with our uses, though I do find that less likely. And, this is not limited to us. The HamWan high speed data network that our brethren have built in Washington State could be well within range of the ISS at a time that the ISS is also in view to us in Hawaii. In fact, when the satellite is at our radio horizon, the satellite's radio horizon reaches all the way into Colorado.

I have cautioned them that if they do operate in the broadband portion of the 13cm band, and are indeed operating spread spectrum, §97.311 would require them to not cause ANY harmful interference to other stations, and that they must accept all interference caused by stations employing other authorized emissions; even if those other stations are uncoordinated. Should interference occur, even if the space station is on a secondary or tertiary basis to ours, the case could be made that once the bird is already in the sky, it is so impractical to change its frequency or band so as to be considered impossible.

That then is strong case to then make the Amateur Radio Service subordinate to their commercial use.

Because operating at altitude affects a larger area, it becomes an issue affecting the use on a large scale.

On the commercial nature of the request:

The spirit and intent of amateur radio in the United States is clearly defined in Part 97 to be non-commercial in nature. On its face, the presented request may seem to be non-commercial, insofar that it is education related. However, there are many circumstances in which university hosted research is commercial in nature. For this reason, and many others, universities are required to obtain

Tim Bryan's Resto documentary to debut at September meeting at Keaau Community Center

September's BIARC meeting will feature the premiere of Tim Bryan's (KH6TOB) video on Puerto Rican ARRL Section Manager Oscar Resto's (KP4RF) mission last year to the 50th state.

Oscar was key in the vital ham response to Puerto Rico's devastating hurricane Maria. All are welcome at the 2 p.m. gathering Saturday, Sept. 14, at the Keaau Community Center.

commercial licenses for the non-ISM radio systems they operate. This is as true for their space stations as it is for their terrestrial microwave stations. The University of Hawaii is not entitled to, and in fact does not use, amateur radio frequencies for their microwave system. That system supports research like that being done at the observatories on Mauna Kea. That research not materially different in nature from the research to be conducted by the NEUTRON-1 team. The frequencies that UH uses for their microwave system are commercial frequencies licensed to them by the FCC. I see no indication in the request that the NEUTRON-1 mission is of any different of a nature. I do not believe that it falls within the bounds of non-commercial use as described in subsection A of the Basis and Purpose statute, which authorizes amateur radio operations: §97.1(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications. Therefore, I believe that this is likely an application that is commercial in nature, may be subject to frequency coordination by the ITU through the Advance Publication Information process, and almost certainly requires Part 5 experimental licensing by the FCC.

Research may be a basic tenet of amateur radio; so much so that it is codified in subsection C of the Basis and Purpose statute: §97.1(c) Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

This subsection makes it clear that the research permitted and encouraged in amateur radio is to center on the art of radio

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From previous page

transmitting and receiving in and of itself. Experimenting with new technologies, methods and modes are all fair game under our licenses. These are explorations of the technical phases of the art. Using the spectrum allocated to us to support other endeavors, simply because they are research related, clearly is not. Research requiring the use of radio spectrum, as opposed to research OF the use of radio spectrum, has been deemed commercial in nature.

Amateur radio operations must be voluntary in nature. We are prohibited by law from receiving compensation in relation to our operation in the Amateur Radio Service. Not all of the personnel involved in this project will be unpaid. Though there is an exemption for wages received by educators when the operation in the amateur service is coincidental to the instruction being given; that exemption is not available in this case. The operation within the Amateur Radio Service in this case is not incidental to instruction. The purpose of the education is clearly not related to the method of communication, and therefore is not incidental. further, the exemption codified in §97.113(3)(iii) of the Prohibited Transmissions statute requires that such an activity be classroom based:

A control operator may accept compensation as an incident of a teaching position during periods of time when an amateur station is used by that teacher as a part of classroom instruction at an educational institution. Research projects such as NEUTRON-1 are not classroom activities. That further bolsters that this request does not meet the non-commercial requirement of the Amateur Radio Service.

In light of the above, what I believe that we are facing is a request to permit commercial operations within the spectrum allocated to the Amateur Radio Service. The NEUTRON-1 team and I have discussed in great length the concerns of their use being commercial in nature. They have elected to seek the assistance of local amateur radio operators to assist in the operation of the ground station at Kauai Community College. They state that they are now seeking to educate and then license students from Kauai Community College, so that they may fill that role. They have also decided to evaluate the possibility of using the HSFL ground

station on Oahu, so that they can employ the same strategies in Honolulu.

I personally feel that this is a great addition to their program, and is a benefit to the amateur radio community. I also believe that this puts them on much firmer ground to qualify for Part 97 operation. However, they state that they intend to use the paid faculty member as a backup operator, should the need arise. He is a licensed amateur, but they are unsure how his compensation for the activity would comply with Part 97.

On permitting commercial operations using amateur radio spectrum:

Spectrum is a finite resource. As such, it is an incredibly valuable resource. So much so that any free sliver of spectrum is auctioned off. These allocations often command billions of dollars when purchased.

Amateur radio is unlikely to be granted additional spectrum. It's just too valuable. We are more likely to face increased pressure, and may ultimately continue to lose spectrum. We should be extremely protective of the spectrum allocated to us. If we lose it, we will never be able to compete financially to get it back.

With my belief that the included request is commercial in nature, it would be a slippery slope to permit this activity within our spectrum; even on a secondary or tertiary basis. Once the operation is permitted, it will open the door to other requests. Future requests may not be as friendly as the one we consider today.

On other Part 97 compliance issues: In addition to the proprietary protocol, there are additional issues with their 2.4GHz radio which may make it unsuitable for use in the Amateur Radio Service. Their NEUTRON-1 team stated on their application to the FCC that this is an OFDM QPSK modulated signal. However, they are insistent that this is a spread spectrum radio. There appeared to be significant confusion on their actual data link protocol and encoding.

The NEUTRON-1 team is steadfast that they must use a proprietary protocol on their 2.4GHz radio, because it does not support any open protocols. I have cautioned them that obscurity of the message through the use of a proprietary protocol is a separate issue which may run afoul of the requirements of Part 97. I highlighted the history of PACTOR and AMTOR as an example.

However, they haven't been willing to budge on this. I see this as a significant impediment to their compliance with Part 97. Their VHF uplink and UHF downlink will be operating using the AX.25 protocol, so this is not an issue for those radios. In fact, AX.25 is protocol developed specifically for amateur radio use. The

Continued on next page

From previous page

NEUTRON-1 team tells me that the most basic of their research figures, the observed neutron count, would be obtainable by the amateur radio community by monitoring the UHF downlink.

Another as of yet unresolved concern is how their ground station would identify -- space stations are exempt from the identification requirements, but their ground station is not. I have highlighted to them that if they were using a proprietary protocol, the idea of putting an ASCII station identification in the packet headers would likely not satisfy §97.119, since the signal itself could not be decoded to view the headers. Their idea that anyone could go buy the proprietary radio and software, then try to decode the signal to see the packet headers containing the ASCII identification, is not likely to change the FCC's mind on required station identification.

It is clear that the part 97 compliance of their 2.4GHz radio protocol is the current "make it or break it" item for their mission, if they are to operate in the amateur radio service. They are going to work with the equipment manufacturer to determine if the radio can be operated using an open protocol. That determination will likely make more of an impact on their application than any other concern discussed. Because of this they believe that the FCC will mandate that they operate under Part 5 experimental operation. They have offered to add a digi-peater function to the VHF uplink and UHF downlink radios, specifically for amateur radio operators to use.

However, the consensus is that the inclusion of an amateur radio feature does not negate the requirement to comply with Part 97 for all operations in the Amateur Radio Service.

On my support for their mission:

I am an ardent supporter of STEM education. Coincidentally, my "President's Corner" article in last month's Big Island Amateur Radio Club newsletter likely made that clear. That article was written a full week before the NEUTRON-1 team's email to BIARC. I donate my time to efforts such as the UH/HCC Academic Advisory Council for Electrical Engineering and Electronics. I am a member of the IEEE - the Institute for Electrical and Electronics Engineers. I truly do support the mission that these students and their advising faculty have put together. It

pains me to not be able to support their mission.

I am disheartened that our lack of consent may jeopardize their mission. I come from a family heavily involved in the space race, and present day space exploration. My grandfather was an electrical engineer and computer scientist supporting the space program from the Apollo missions to the space shuttle days. My father is a mechanical engineer working as a fluid dynamics specialist - real life embodiments of the proverbial rocket scientist role.

I place a high value on higher education. I especially value STEM programs, which I see as the gateway to a better and more diversified economy on our island. STEM jobs are able to be located anywhere on the planet. I believe that the opportunities in STEM that we give to our keiki will result in the growth of our species, the solidification of their prosperity, and the diversification of income to our community. The manufactured boundaries which have limited the success of women and minorities in other industries do not present as great an impediment in the new STEM world. They're not gone, but there is progress.

All of this is very important to me personally. I say all of this so that you know that I would never jeopardize the STEM opportunities without adequate justification. I'm pretty sure that most of you feel the same way.

Being a former law enforcement officer, suspicious is my basic state of existence. Why was this presented to us with so little notice? Why are we being given so little detail to justify the encroachment on our spectrum?

The more rational part of me whole-heartedly believes that there is no intent of malice behind their request. However, caution is still advised. I do not believe that there is premeditation to grab our spectrum. Please do not read my above comments as an accusation toward these fine people and their mission.

On unintended fallout:

Quite unfortunately, last week, BIARC had to turn down another request to assist with a Hawaii Space Flight Laboratory satellite project. This one was sent to us by the Hawaii Science and Technology Museum staff, right here in Hilo. This project appears to be a much better fit for the Amateur Radio Service.

The Hawaii Science and Technology Museum was chosen for the project because they have a STEM program which works with middle school and high school students. This is the exact type of program for which I have been advocating. Unfortunately, since the launch is a Hawaii Space Flight Laboratory project, until the above issues are resolved, the Hawaii Science and Technology Museum team is facing some of the same Part 97 compliance issues.

Continued on next page

From previous page

I did offer to engage, as an individual, in technical discussions with their team, and the kids in the program. I very much encourage any other ham who would like to help them along in their program to do so as well. They need our help. We may not be able to officially sanction their use of the Amateur Radio Service spectrum; but I personally believe that we do have an obligation to teach them our art.

They need guidance on matters such as antenna selection. Anyone who wishes to contribute to that program should reach out to them directly. Below is the email they sent starting the conversation, and the Director's contact information.

"I have more information about the contributions you and BIARC can make to our project if you can lend us some of your expertise. I've copied an email one of our engineers working on the project sent below, right now our main hurdle is getting FCC licensing to have a CubeSat that can transmit down to you folks using a UHF radio we mount on the satellite. Here's a clip from her email:

"Second, for the antenna/radio. I briefly looked into the FCC licensing issue... we may be able to qualify for amateur status, if there is no commercial or government involvement, including funding... if Hawaii gov ends up funding, then we'd need to go with experimental. In fact, is HSFL considered government? For experimental, we'd be an STA Form... etc. I was starting to read Chapter 5 (pg 43) here: https://www.nasa.gov/sites/default/files/atoms/files/nasa_csl_i_cubesat_101_508.pdf. The HAM radio community will have some ideas on certain transmitters and antennas to use (certainly you could use a transceiver, but bare minimum is transmitter)... I can do a little more digging later tonight, as well. Maybe first step is to get an FCC application started, as Amber mentioned that could be the tall tent poll. Think we'd want 2 antenna on either side of the CubeSat to make sure it can be picked up in any orientation -- my friend mentioned there are inexpensive ones on DigiKey. I went to the site and had no idea where to start... maybe HAM will know better...?"

Also, here's the link to the video of the news story HNN did about the project, so you and your members have a little background info about what we're trying to do. Thanks!

<https://www.hawaiinewsnow.com/2019/08/15/non-profit-partners-with-big-island-students-build-satellite-space->

exploration/
Christian Wong, Executive Director, hawaii
sciencemuseum.org, Hawaii Science and
Technology Museum, P.O. Box 7195 Hilo, HI
96720; (808) 938-3751"

73,

William Polhemus, NH6ET

Hawaii amateur radio operators receive SSTV Images from the ISS

Flying past Earth in Low Earth Orbit, LEO, at a whopping 5 miles-per-second. That means the International Space Station, ISS, circles the entire planet once every 90 minutes. The ISS is 220 to 248 miles above Earth.

Amateur Radio Operators from around the world track and listen for the ISS as it flies overhead, and with this being the 50th Anniversary of Amateur Radio in Space there is some added activity.

ARISS, Amateur Radio on the International Space Station, has planned events to celebrate that milestone. In early August 2019, the ISS sent signals down to earth as it crisscrosses space. The signals included Photos of astronaut, scientist and ham radio pioneer Owen Garriot. These photos are sent via a mode called Slow Scan TV, SSTV, and can be decoded with an app on a phone, a computer program and the use of a small hand held radio and antenna.

Numerous operators in Hawaii successfully decoded the signals and posted their photos to the ARISS website. Local Hawaii Hams often post their photos at the facebook group, hamradiohawaii.

Listen to the Space Station crew use Ham Radio to call Earth. [https:// www.youtube.com/watch? v=h73EYcysz8](https://www.youtube.com/watch?v=h73EYcysz8)
<https://www.icloud.com/message/current/en-us/index.html#view?guid=message%3AINBOX%2F725644/58/11/2019>
iCloud Mail

You can practice by putting your app up to your computer speaker and playing youtube SSTV signals. Listen to SSTV Signals from the ISS. <https://www.youtube.com/watch?v=sG4UhlByFyw>

**Stacy Holbrook
KH6OWL**

Mark your calendars: Grid Madness 2019 set for Sunday, Sept. 15

Stan Froseth, AH6KO, event manager, announces that Hawaiian Islands Grid Madness 2019 -- the sixth annual running of the fun statewide event -- is set for Sunday, Sept. 15.

The popular VHF/UHF simplex event will run from 1300 to 1700 HST.

Everyone is invited, so put it on your calendar, says Stan.

For complete info, go online to gridmadness.blogspot.com.

"Grid Madness is for all hams in the State of Hawaii. This event is designed for FUN, and to test your equipment, coverage and operating skills using simplex FM on 2 meters and 70 cm," says Stan.

"Contact as many stations as you can in as many Grid Squares as you can, using SIMPLEX

ONLY."

Grid Madness offers a great "Get on the air" operation for new hams and

good emergency communications practice for responder groups.

"It's a fun activity for everyone -- see who you can contact locally or across the water."

New for 2019:

-- Madness Mitigation -- Additional designated channels on 2m and 70cm, with suggested use of calling frequencies.

For comments and questions, send a note to Stan at AH6KO@arrl.net.



W.A. Cat, official mascot for the Hawaiian Islands Grid Madness 2019.

Tech License course schedule

Doug Wilson's annual county-wide free Technician License course schedule wraps up in October. The six-week courses include five training sessions, with licensing exams given on the final week. The last session of the year begins Oct. 17 at the Keaau Community Center. The classes are free, with the normal \$15 testing fee to ARRL, whose VEs (volunteer examiners) conduct the testing for the Federal Communications Commission. As always, current licensees wanting to upgrade also may take tests for advanced licenses at that time. To register for the classes, or for more info, contact Doug, KH7DQ, at douscelle@aol.com.

10-10 International Aloha Chapter

Local hams active on 10-meters encourage amateur radio licensees at all levels to join in the fun. [More info on the world of Ten-Ten is available on Facebook and at <https://www.ten-ten.org>]

DXpedition team donates part of QSL fees to Galapagos Conservancy

From February 28 until March 6, the HD8M Amateur Radio team operated from the side of Cerro Crocker, a volcano high above the city of Bellavista on Santa Cruz Island in the Galapagos.

The HD8M team consisted of Jim Millner, WB2REM, a retired psychologist, and Bill Mims, W2WCM, a retired airline pilot. The

purpose of the operation was to bring attention to the fragile ecosystem of the Galapagos Islands through their Amateur Radio activity. As a part of the confirmation process, the team exchanged QSL cards from which a dollar or more would be donated to Galapagos Conservancy.

"We used ClubLog's Online QSL Request System (OQRS), bureau requests associated with ClubLog, and SASEs for QSLing," Millner explained. "When stations used OQRS and requested a direct QSL Card, they were charged a \$4 fee. We mentioned in the OQRS system that of every \$4 received, we were going to donate \$1 to the Galapagos Conservancy. As it turned out, however, we donated all



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extra money to the Conservancy."

At the time, the HD8M team was the only Amateur Radio operation in the Galapagos Islands, making it a rare entity, so they found themselves in high demand. In just 6 days of operation, they contacted more than 8,000 stations in 140 DXCC entities as well as in all 50 US states. Millner and Mims operated two stations equipped with Icom IC-7300s and band-pass filters, operating on SSB, CW, and FT8, and using all wire antennas. HD8M took part in the ARRL International DX Phone and, despite poor conditions on the equator, they were able to make more than 600 contacts.

"FT8 was a particularly a good mode despite the conditions," Millner said, noting that the location at 1,500 feet

Continued on next page

From previous page

elevation on the side of a volcano gave the pair "an amazing view" of the ocean and outlying islands.

"The wildlife was abundant with many colorful birds and land iguanas, as well as huge Galapagos tortoises that roamed around the 10-acre property.

In addition, they added a fundraising component to their outreach and on their website, where donations were made directly to Galapagos Conservancy. As a result of HD8M's unique approach to fundraising, they were able to donate \$2,285 to the Galapagos Conservancy in April. In September 2017, the HD8M team operated from Isabela Island, and amassed \$1,200 in donations to the Conservancy. -- ***This is an expanded version of a story that appeared in Galapagos News spring/summer 2019 issue and appears by permission.***

Dhruv Rebba, KC9ZJX, is 2019 Newsline Young Ham of the Year

Fifteen-year-old ARRL member Dhruv Rebba, KC9ZJX, of Normal, Illinois, has been selected as the 2019 Bill Pasternak, WA6ITF, Memorial Amateur Radio Newsline Young Ham of the Year (YHOTY). His parents are Hari Rebba, VU2SPZ, and Shailaja Panyam.

A rising sophomore at the Normal Community High School, Dhruv is a member of the Central Illinois Radio Club. He has been licensed since 2013, after a visit to Dayton Hamvention with his dad sparked his interest in Amateur Radio.

After getting his license, Dhruv became involved in ARRL Field Day and public service events with the Central Illinois Radio Club, including the We Care Twin Cities Half Marathon and the Hop on for Hope Bike Ride/Walk. Dhruv says he found a way to combine his interest in space and engineering with his new hobby, joining AMSAT and pursuing his dream of a school contact with an astronaut aboard the International Space Station.

In October 2017, he served as lead control operator for an Amateur Radio on the International Space Station (ARISS) contact with students at his school, Chiddix Junior High, who spoke to astronaut Joe Acaba, KE5DAR. On July 27 of this year, Dhruv helped to facilitate

another ARISS contact with Scouts attending the World Scout Jamboree in West Virginia.

Centenarian radio amateur's efforts helped pave the way to the moon

The Nashville Tennessean newspaper recently featured the story of a 104-year-old ARRL member who contributed to NASA's effort to put the first humans on the moon 50 years ago this month.

Cary Nettles, W5SRR, of Columbia, Tennessee -- who calls himself the nation's oldest rocket scientist still alive -- was a NASA project manager and research engineer on rocket propulsion systems in the 1950s and 1960s.

While working on the Centaur second-stage rocket program, Nettles determined that the rocket engine failures NASA was experiencing were a result of misdirected exhaust destroying the vehicles' engines.

Nettles told the Tennessean he came up with an "exhaust pipe" that solved the problem. In May 1966, an Atlas-Centaur launcher propelled the first Surveyor lander toward the moon. That year, NASA awarded Nettles and colleague Ed Jonash its Distinguished Service Medal for "superhuman effort in turning the troubled rocket into a reliable upper stage," according to a 2004 NASA publication, "Taming Liquid Hydrogen -- The Centaur Upper Stage Rocket 1958-2002."

In 1969, a Saturn V rocket with a liquid hydrogen-fueled second stage carried astronauts Neil Armstrong, Buzz Aldrin, and Michael Collins to their rendezvous with the moon. Nettles retired from NASA the following year.

Nettles got his Amateur Radio license in 1945 and remains active on 40 meters as well as on VHF and UHF repeaters. He is a member of the Maury Amateur Radio Club. In addition to sustaining his interest in ham radio over the decades, Nettles is an enthusiast of "large-scale" steam trains, which he works on in his basement.