

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of:

**Streamlining Licensing Procedures for
Small Satellites**

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IB Docket No. 18-86

To: The Commission

REPLY COMMENTS OF FACULTY/AMATEUR RADIO MENTORS OF A FEDEERAL "UNIVERSITY"

The below licensed Amateur Radio faculty, student project mentors, and licensed Control Operators for a federal funded "university" significantly involved in small satellite education, pursuant to Sections 1.415 and 1.419 of the Commission's Rules [47 C.F.R. §§ 1.415 and 1.419], hereby respectfully submit reply comments in response to the *Notice of Proposed Rule Making and Order*, FCC 18-44, 83 Fed. Reg. 24064, released May 24, 2018 (the Notice) and in support of comments filed by the Radio Amateur Satellite Corporation (AMSAT). These comments are timely filed. Our comments, we state as follows.

I. Background

We are active Amateur Radio operators that participate in the mentoring of student senior engineering capstone projects at a major federal "university" which sometimes result in Amateur Radio transponders and radios and small satellite projects. The goal of these individual student projects is to allow students to gain hands on experience in working with hardware and software and project management experience in support of their academic engineering major.

We have mentored at least 6 successful small satellite student Amateur Satellite projects since our first in 2001. The first was PCSAT still semi operational after 17 years and widely used around the world by ham radio operators for communications experiments. The Smithsonian has our engineering model on display at the Udgar/Hazy facility as an example of a "student built amateur satellite". Subsequent projects were PCSAT2 in 2006 that operated for a year attached to the outside of the ISS, and ANDE and

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RAFT spacecraft that contained amateur radio transponders and were deployed from the ISS in 2006. Further, these satellites all supported a common amateur communications protocol that was also incorporated on the Amateur Radio permanently onboard the ISS (ARISS) since the 2008 time frame. Subsequent student projects (with compatible Amateur transponders) are PSAT and BRICSAT launched in May 2015 with PSAT still fully operational and used worldwide by hams eager to communicate via its transponder (See <http://pcsat.findu.com> for live downlink).

Over these 17 years our students Amateur Satellite projects have both demonstrated the public utility of the Amateur Satellite Service and proved that small, inexpensive satellites can be built by students with a project mission and goal for providing reliable communication, store-and-forward messaging, and file transfer for a wide variety of amateur radio missions. Due to our successes, many other schools and students have become interested in the small satellite and Amateur Radio art.

These student amateur satellite projects are an efficient use of both orbital and radio spectrum resources. Amateur radio operators worldwide are able to utilize the communications services the satellites provide while also collecting telemetry and experiment data for their own self training in the radio art as well as their academic experiences.

Although the Notice does not propose any rule changes directly affecting the Amateur Satellite Service, there is significant potential impact on that service because of the present tendency of the FCC to place many Experimental Part 5 satellites inside the Amateur Radio bands in competition with Amateur Satellites. We offer these comments on issues relating to the authorization of small satellites in the Amateur Satellite Service.

II. General comments: While the NASA maximum mass of 180 kg demarcation point [Notice p16] makes sense compared to typically large 1800 kg satellites, it is still more than 2 orders of magnitude larger than the typical 1 kg cubesat which is a stated objective of this Notice. We think there needs to be a third category distinction on the order of 18 kg too. This smaller size inherently limits electrical power

Comments of Faculty and Student Mentors at a federal "university" – IB Docket No. 18-86 and so this can be combined with a possible bandwidth restriction as well where it impacts spectrum. Maybe 100 kHz can be a differentiator. **Secondly**, the 10 cm³ size limit [Notice p18] might be misinterpreted as 1/4th the size of a golf ball - where we think the intent was the example of a 10x10x10 cm cubesat. A better specification might be 1000 cu-cm?

III. Many Small Satellites Built by Universities and Non-Profit Organizations can Qualify for an Amateur Satellite Authorization when they are clearly designed for an Amateur Radio Mission.

The Notice states "because the type of operations that qualify as amateur are narrowly defined, an amateur satellite authorization will not be appropriate for many small satellite operations." [Notice p.9]. Contrary to the text of the notice, we believe the types of operations that are appropriate for the Amateur Satellite Service to be relatively broad. In addition to providing communications resources to the amateur community, an amateur satellite may also be used for "self-training and technical investigations relating to radio technique." The International Amateur Radio Union (IARU) further defines the radio technique to mean "having a reasonable possibility of application to radio communications systems." Examples provided of experiments relating to radio technique include a wide variety of experiments commonly included on small spacecraft, including attitude determination, sensors to study spacecraft performance, radiation effects on electronic components, and measurements of the orbital environment.[1]

As described in the previous section, amateur satellites have a long history of completing a wide variety of experiments relating to radio technique other than the provision of amateur communications resources. Section 97.1 of the Commission's rules also recognizes that the basis and purpose of the Amateur service extends beyond that of a "voluntary noncommercial communication service." Additional purposes of the Amateur service include "the advancement of the radio art" and "advancing skills in both the communication and technical phases of the art." Clearly the construction and operation of new types

[1] "Amateur Radio Satellites: Information for Developers of Satellites Planning to Use Frequency Bands Allocated to the Amateur-Satellite Service." The International Amateur Radio Union. http://www.iaru.org/uploads/1/3/0/7/13073366/iarusatspec_rev15.7.pdf. Pg. 7. Retrieved 6/18/18.

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of satellites fits within these purposes. Through student and volunteer participation in these projects, they serve to expand “the existing reservoir within the Amateur radio service of trained operators, technicians, and electronics experts.” As amateur operators around the world are invited to both utilize amateur satellites and collect and submit telemetry as they pass overhead, their operation serves to “enhance international goodwill” [47 C.F.R. § 97.1].

While a majority of small satellites built by universities and non-profit organizations are not currently providing designated two-way communications resources to the amateur community, many are generally conducting experiments relating to radio technique and fulfilling the additional purposes listed in Section 97.1 of the Commission’s rules. Therefore, many of these satellites can qualify for an amateur satellite authorization as long as there is no obvious conflict of interest or other violation of the rules. Some of these may also not be including Amateur Radio experiments due to the recent perception that the FCC will not approve of any Amateur Satellite licensing except under the most narrow restrictions and filing such an Amateur Advance Notice API will add risk and encumber their main payloads.

IV. Amateur Licensing for Satellites Built by Universities and Non-Profit Organizations

RR 1.56 of the ITU Radio Regulations provides that stations operating in the Amateur service must be controlled by individually licensed amateur radio operators acting “solely with a personal aim and without pecuniary interest.”[2] Section 97.207 of the Commission’s regulations notes that an individual amateur licensee must be the control operator of an amateur satellite and that this individual licensee is responsible for the operation of the station. [47 C.F.R. § 97.207] A university or non-profit organization cannot obtain a license to operate an amateur satellite under its own name. Additionally, section 97.113 of the Commission’s regulations prohibits communications in which a licensee “has a pecuniary interest, including communications on behalf of an employer.” [47 C.F.R. § 97.113(c)].[3]

[2] ITU Radio Regulations, RR 1.56.

[3] The “teacher exception” in § 97.113(c) allows professors or others in a teaching position at a university to serve as the control operator and/or licensee of an amateur satellite built at that university.

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This is not an insurmountable barrier to amateur authorization. The IARU notes "organisations and amateurs have common interests and work together for their mutual benefit"[4] For example, AMSAT is a non-profit organization that has constructed and launched several amateur radio satellites. An unpaid volunteer serves as the licensee and control operator for these satellites and is legally responsible for the operation of those satellites. AMSAT's interest in the operation of the satellites as the owner, and our volunteer's personal interest in the operation of the satellite as the operator are the same. Any university or other non-profit organization can follow the same model by working with a volunteer, perhaps from the organization's own amateur radio club or another local amateur radio club.

There is one important restriction in the Amateur Satellite Service and that is the prohibition of codes and cyphers. We concur in this restriction. Although 47 C.F.R. § 97.207(f) states that "space telemetry transmissions may consist of specially coded messages intended to facilitate communications or related to the function of the spacecraft," the Commission has routinely noted that "Section 97.113 is intended to help maintain the non-commercial character of the Amateur radio service by prohibiting certain types of transmissions" and "to ensure that the Amateur Service remains a non-commercial service and self-regulates, amateur stations must be capable of understanding the communications of other amateur stations." [5] Additionally, RR 25.2A of the ITU Radio Regulations states that "transmissions between amateur stations of different countries shall not be encoded for the purposes of obscuring their meaning." [6] The IARU interprets this to require amateur satellite operators to publicly disclose the information necessary to decode telemetry and data transmitted by the satellite and expects missions resulting in an increase in the amount of data available for analysis. However, if a university or non-profit organization requires their satellite's data to remain proprietary, then the Amateur Satellite Service is not

[4] "Amateur Radio Satellites: Information for Developers of Satellites Planning to Use Frequency Bands Allocated to the Amateur-Satellite Service." The International Amateur Radio Union. http://www.iaru.org/uploads/1/3/0/7/13073366/iarusatspec_rev15.7.pdf. Pp 7-8. Retrieved 7/3/18.

[5] "Order In the Matter of Don Rolph Petition for Rulemaking to Amend Part 97 of the Commission's Rules Governing the Amateur Radio Service to Provide for Encrypted Communications." DA 13-1918, Federal Communications Commission, Released September 18, 2013.

[6] ITU Radio Regulations, RR 25.2A

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appropriate and they must seek another service in which to license and operate the satellite.

Further, public disclosure benefits missions using amateur frequencies as there are hundreds of enthusiasts around the world ready to decode satellite telemetry and send it to the satellite owner,

V. Federal Funding Should Not Bar Amateur Authorization

Amateur Satellite projects have recently come under FCC scrutiny for their suitability for the Amateur Satellite Service apparently based on the organization in which Amateurs may work on Amateur Satellite projects and/or the project’s funding sources. For example, our student projects frequently use parts consumables from our federally funded “university’s” academic stock and may purchase additional specialized parts within the typical few thousand dollar or so budget for all individual student projects. However, to avoid even the appearance of a conflicting pecuniary interest of these student projects we specifically exclude any external military or government research funded experiments from those projects to be licensed in the Amateur Satellite Service. The goal is always self-training in the small satellite and radio art. It should be noted that 85% of every other student engineering project at this federal institution these days uses RF links of some kind under any number of other FCC services and are *not* required to file with the NTIA or use federal frequencies (WiFi, FRS, part 15, Radio Control, CB, and others). Why is the FCC singling out part 97 as not appropriate for our students?

Other examples are the NASA funded projects at universities and non-profit organizations who obtain launches for satellites through their CubeSat Launch Initiative (CSLI). Because of this recent FCC scrutiny, NASA advises all projects to obtain experimental licenses. This essentially kills this route for what can otherwise be perfectly valid amateur radio experiments. NASA guidance states, of amateur authorizations, that “this designation is intended for satellites that will be used by amateur operators only. There can be no Government or commercial involvement in the development or operation of the CubeSat.

So, if your CubeSat project is being funded by a Government grant, or built by students at a

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government “university” you are disqualified from getting an amateur designation.”[7] We find no basis in the Commission’s rules to support denying an Amateur authorization solely because a portion of a satellite or its launch is funded by a government grant. Section 97.207 of the Commission’s rules state “any amateur station may be a space station” [47 C.F.R. § 97.207(a)]. Generally, the Commission does not regulate the ownership and/or funding sources of amateur station equipment. Rather, the Commission regulates the operation of that equipment. The Commission’s regulatory interest is not in the ownership and/or funding source of the satellite, but that the satellite is operated by a duly licensed amateur control operator in full compliance with the Commission’s rules. .” The current FCC position makes it virtually impossible for students at our federal school and also at most universities to ever choose to build an Amateur Satellite for their projects. This appears to be arbitrary and capricious and not in the spirit of part 97

VI. Satellites Licensed Under Part 5 without any Amateur Radio Interest Should Not Utilize Amateur Frequencies

As active amateur radio operators, faculty, and student project mentors, we oppose the licensing of satellites in the amateur bands under Part 5 of the Commission’s rules when there is no possible amateur radio mission. Satellites not able to be authorized under Part 97 should utilize spectrum outside of frequencies allocated to the amateur or amateur satellite service. On the other hand, as stated above, we believe that many satellite missions currently carried out by universities or non-profit organizations in the amateur bands under Part 5 licenses in fact, could be eligible for amateur authorizations. These missions should seek amateur authorizations if it applies and should not be forced into Part 5 licenses.

Another significant problem unique to our undergraduate institution as a federal funded “university” is that the FCC rules clearly prevent any possibility of an experimental license. Part 5 experimental licenses though very popular and in fact encouraged by the FCC for all universities may

[7] CubeSat 101: Basic Concepts and Processes for First-Time CubeSat Developers. NASA CubeSat Launch Initiative. Pg. 45. October 2017.
https://www.nasa.gov/sites/default/files/atoms/files/nasa_csli_cubesat_101_508.pdf . Retrieved 6/18/18.

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only be used for non-federal institutions. In the past, this has left institutional licensing for our student’s projects exclusively via the NTIA and allowed for no possibility of our students to choose to build an amateur satellite like their student compatriots at all other universities. This catch-22 directly impacts our students, our faculty and our mentors and control operators because the NTIA does not have spectrum in the Amateur Satellite bands where the amateur mission users are. And even if an FCC/NTIA exception is made, all other amateur users cannot access the satellite unless it is also filed via the FCC part 97 process. *We understand that there may be a process is in work to use dual-licensing to address this issue though at this time we do not yet have anything in writing.*

Further, the Commission’s current “Guidance on Obtaining Licenses for Small Satellites” requires operators seeking a Part 5 experimental license utilizing amateur frequencies to obtain IARU coordination before applying for the license.[8] However, since August 1, 2017, the IARU will only provide frequency coordination for “a non-amateur satellite if an administration directs in writing that it be operated in an amateur-satellite band under an experimental or other non-amateur license.”[9] This results in a confusing “Catch-22” situation for satellite builders.

Experimental licenses (as well as NTIA licenses) also limit flexibility for both satellite operators and the amateur radio community. Stations licensed under Part 5 of the Commission’s rules (or NTIA) are generally only permitted to communicate with other stations licensed under the NTIA or Part 5 [47 C.F.R. § 5.125]. This prevents any amateur operation of the student project space communication system even when it was designed to include that mission.

Although the Commission’s regulations do permit the granting of temporary special authority to communicate with non-experimental stations in circumstances such as these, an amateur authorization

[8] “Guidance on Obtaining Licenses for Small Satellites.” Public Notice, Federal Communications Commission. March 15, 2013. https://docs.fcc.gov/public/attachments/DA-13-445A1_Rcd.pdf. Retrieved 6/18/18.

[9] “IARU Aligns Satellite Coordination Guidelines with ITU WRC-15 Decisions.” June 30, 2017. The International Amateur Radio Union. <http://www.iaru.org/news—events/iaru-aligns-satellite-coordination-guidelines-with-itu-wrc-15decisions>. Retrieved 6/18/18.

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The prohibition on stations in the amateur service communicating with satellites licensed under NTIA or Part 5 (but also within the amateur radio bands) also restricts the ability of these satellites to conduct secondary communications missions for the benefit of the amateur community. Much of the commercially available CubeSat hardware can be utilized for amateur radio digital or voice communications. These features could be activated either following the conclusion of the primary mission or at specified times during the primary mission.

As FCC licensed student project mentors, we routinely encourage student satellite projects to incorporate and activate communications features in their satellites for use by Amateur Radio operators worldwide. Unfortunately, these features cannot be activated for the benefit of the amateur radio community if the satellite is licensed under Part 5 of the Commission’s rules or any other regulatory process such as via NTIA.

For these reasons, we believe that the limited number of non-commercial small satellites not suitable for licensing as amateur satellites should be assigned frequencies outside the bands allocated to the amateur satellite service. And conversely, there are many non-commercial small satellite missions that are by their nature fully suitable for operation as Amateur Satellites and should not be denied amateur radio part 97 licensing process.

VII. Conclusion

We appreciate the Commission’s interest in examining the licensing rules for small satellites. Builders and operators of satellites in the amateur satellite service continue to provide immense value to the growing field of small satellites by serving as a platform for experimenters to conduct a wide variety of experiments relating to the radio technique. As noted above, experiments conducted by amateur satellites

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have informed and continue to inform the development of the commercial small satellite industry.

Additionally, student participation in amateur satellite projects provides both inspiration for young men and women to pursue careers in the satellite industry and practical experience for those careers. Amateur satellites and transponders over the last 55 years have directly inspired the creation of this rapidly expanding industry. A strong and robust amateur satellite service including student projects will continue to benefit the public interest and inspire future developments in satellite technology.

And finally, the problem of the proliferation of small satellites that this Notice is attempting to address with the streamlining of the FCC licensing procedures is equally being faced by federal agencies and their small satellites within the NTIA. While beyond the scope of the FCC and this notice, care should be taken by the FCC in the definition of restriction categories based on relative size, weight, bandwidth or other restriction boundaries and definitions so that they will match similar boundaries and definitions possibly being developed within the NTIA. This problem is exacerbated in our case by the apparent unique stance of the FCC to require dual-licensing of our student's Amateur Satellites via both the NTIA and FCC.

We find no basis in the Commission's rules to support this requirement now being applied uniquely to some of our student's projects that are to be operated as individually licensed student Amateur Satellite projects designed to be fully within the part 97, and ITU rules and IARU recommendations. The student projects are not operated by the Institution but are designed to operate solely under the individual license of the control operator and amateurs around the world as has worked well for the last 55 years of the Amateur Satellite Service. Placing this unique dual licensing requirement (one individual, and one institutional) is a unique burden applied to no other university.

RESPECTFULLY SUBMITTED,

Student Amateur Satellite Project Mentors:

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