

Corporation (AMSAT). In those Comments, AMSAT suggests the nature of the modifications needed that would achieve the Commission's expressed regulatory objectives without needlessly impairing the amateur satellite service. Specifically:

- The Commission should exempt amateur satellites or otherwise ameliorate its proposed indemnification requirement. Experience indicates that such a requirement most likely would, as a practical matter, severely restrict or end the almost 60-year history of amateur radio satellites in the United States that have contributed mightily to space developments and education.
- Only communications telemetry used to command onboard propulsion systems should be subject to mandatory encryption. An important aspect of amateur satellite operation is the educational and practical value of widespread copying and reporting of satellite telemetry signals.
- Amateur space stations co-located on spacecraft authorized under Part 25, Part 5, or by the National Telecommunications and Information Administration (NTIA) should be exempt from debris mitigation and indemnification requirements. Under such circumstances the spacecraft owner will have already demonstrated compliance with all such applicable requirements.
- Amateur satellites proposed for disposal by atmospheric re-entry should not be restricted to orbital altitudes of 650 kilometers or below. Amateur satellites are relatively few in number, and should be allowed access to desirable higher orbits when debris mitigation concerns are met.
- The longer duration of amateur satellite missions should be factored into the time required for a satellite to naturally de-orbit or to be transferred to a parking orbit.

The Successes of Amateur Satellite Programs Uniquely Serve Important Public Interest Objectives Critical to Preserving and Strengthening American Interests in Space

Developing the human potential of students and scientists is key to maintaining the United States position in the critical space sector. There is a particular need to foster space science and experimentation in colleges and universities if we are to continue to keep pace and lead in the fast-changing world of space technology. For sixty years the amateur satellite service has made key contributions to this effort on a completely voluntary basis. However, adoption of the Commission's proposed amendments to Part 97 of its Rules enumerated above without modification would threaten the continuation of critical parts of the amateur space effort.

Since the beginning of the “space age” in the late 1950’s, radio amateur satellite enthusiasts have served an important role in national and international space efforts. They have created and encouraged interest in developing the skills and knowledge necessary for success in space-related careers. Continued successes in space rely upon development of human capital, and development of that human capital is furthered by programs such as those conducted by amateur satellite enthusiasts.

The learning and experience acquired by designing, building, and communicating through actual orbiting satellites is irreplaceable. The amateur satellite service has an admirable record of innovation and scientific discovery -- all the more impressive because its accomplishments have been attained with minimal financial backing and cost. These amateur activities have contributed to innovations and developments worth far more than the resources used.

The first amateur satellite, OSCAR I, was built and launched just four years after the Soviet Union’s historic launch of Sputnik, the first artificial satellite. It was thought impossible for private individuals to build and get launched working satellites for a fraction of the cost of the commercial satellites. Yet with only voluntary donations the work succeeded and continues to this day. The work by volunteers in the amateur satellite service has led directly to technologies and developments that are widely utilized by commercial entities engaged in space activities. For example, the latest plans for multiple arrays of low earth orbit satellites to provide Internet-based services to unserved and under-served areas will rely on some of the ideas and technologies first developed by amateur satellite participants.

The success of the amateur satellite service is recognized and acknowledged worldwide by industry and governments alike. The accomplishments are acknowledged, for example, by the International Telecommunications Union’s (ITU) Radiocommunication Bureau.

Most [amateur] satellites have been of the low-Earth-orbiting (LEO) type. Some have been designed for highly elliptical orbits (HEO)... Technology developed in the amateur-satellite service has been applied directly to commercial LEO satellite systems, and the amateur-satellite service has served as a training ground for design engineers.

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The amateur satellite service is highly experimental. It was not certain at the beginning of the OSCAR programme whether small groups of amateurs could design satellites, arrange for their launch, develop sufficient financial resources, and manage orbiting satellites.

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In addition to solving “radio” design challenges, many lessons were learned concerning the physical and thermal design of the spacecraft, attitude control, power system management and orbital mechanics. The amateur-satellite service has proven to be a good training ground for satellite technology.²

The 60-year history of fostering experimentation has had substantial public interest benefits. The future of this program’s base in the United States will be endangered without accommodation on the matters listed above and discussed below. Appropriate accommodation will further the goals of the proposals in a realistic manner while recognizing the differences between the amateur satellite service and commercial satellite services.

Exempt Radio Amateur Satellites or Otherwise Ameliorate Proposed Indemnification Requirements

We are particularly concerned with the indemnification requirement that the Commission proposes to apply to participants in the amateur satellite service. Such a requirement could, as a practical matter, end the ability of amateur radio experimenters and their colleagues to launch and operate amateur satellites under U.S. auspices because of the potential liability and high insurance cost.

Such result would smother, rather than encourage, the type of scientific and technical experimentation with satellite technology that is desperately needed for continued growth in

² ITU Radiocommunication Sector, *Handbook on Amateur and Amateur-Satellite Services* at sections 3.2 – 3.5 (2014 edition). (Available for viewing at: https://www.itu.int/dms_pub/itu-r/opb/hdb/R-HDB-52-2014-OAS-PDF-E.pdf.)

experience and expertise with satellites and space. We note in particular that imposition of an analogous requirement in the United Kingdom seriously hampered the amateur program in that country.³ As AMSAT suggests, declining to apply the proposal to the small number of satellites covered by Part 97, or, alternatively, establishing a common fund for such costs reasonably assessed across users should be considered as alternatives.

Only Communications Telemetry Used to Command Onboard Propulsion Systems Should be Subject to a Mandatory Encryption Requirement

The amateur satellite service has historically relied upon broad-based reporting of its on-board telemetry for both operational and educational purposes. Open publication of telemetry specifications has always been a feature of AMSAT and most other amateur satellites. There is no justification for now generally requiring encryption.

AMSAT publishes information about the telemetry used on each of its satellites and provides open-source software at no cost to users. All may freely decode the telemetry signals emitted by its satellites. In addition to using the telemetry for operational purposes, decoding the satellite telemetry signals has been an important component of educational programs that use AMSAT's satellites for teaching purposes.

We do understand the rationale for requiring encryption of upward command functions that control onboard propulsion systems, but any encryption requirement should be limited to that purpose and function.

³ See discussion in the Comments of Radio Amateur Satellite Corporation at pp. 5-6 (filed April 5, 2019).

Amateur Satellites Proposed to be Disposed Through Atmospheric Re-entry Should Not be Restricted to Orbital Altitudes Below 650 Kilometers

We ask that the Commission continue to provide, in its Part 97 Rules, for the types of LEO experimental satellites that traditionally have been used in the Amateur-Satellite Service. These satellites generally are smaller and intended for longer life than satellites typically used for commercial services. Operation in elliptical orbits higher than 650 kilometers should be permitted if means for atmospheric re-entry is demonstrated to be within 25 years of mission completion as reasonably defined.

The Longer Duration of Amateur Satellite Missions Should Be Factored Into the Time Required for a Satellite to Naturally De-orbit or to be Transferred to a Parking Orbit

Amateur satellites are typically used for their intended mission longer than similar LEO satellites in commercial services. A reasonable mission period for amateur satellites based on the actual and planned longevity of satellites in this service should be included in the time required for mitigation purposes.

Conclusion

We urge the Commission to consider the unique characteristics of amateur satellites and adjust the rules proposed for Part 97 accordingly, as discussed above and more extensively by AMSAT in its comments. Reasonable accommodation of the radio amateur satellites will ensure that such satellites will continue to provide real-world benefits to science, education, and the industry as in the past.

Respectfully submitted,

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By:

A handwritten signature in blue ink that reads "DR Siddall". The initials "DR" are written in a stylized, cursive font, followed by the name "Siddall" in a similar cursive style.

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