INTERNATIONAL AMATEUR RADIO UNION

AND

RADIO AMATEUR SATELLITE CORPORATION

INFORMATION FOR PROSPECTIVE OWNERS AND OPERATORS OF SATELLITES UTILIZING FREQUENCIES ALLOCATED TO THE AMATEUR-SATELLITE SERVICE

I. BACKGROUND.

The International Amateur Radio Union (IARU), established in 1925, is the world-wide federation of national amateur radio societies. The Radio Amateur Satellite Corporation (AMSAT) is a non-profit scientific and educational corporation chartered in the District of Columbia (USA) in 1969.

A major activity of AMSAT is the construction and operation of space satellites either entirely by its own resources or in co-operation with other organisations with similar aims. Satellites designed, constructed, and operated by AMSAT and its collaborators are used by radio amateurs throughout the world and are highly valued resources for students and educators everywhere.

Organisations with similar purposes are now established in many countries throughout the world and most use "AMSAT" somewhere in their name. Consequently, the Radio Amateur Satellite Corporation chartered in the USA is often referred to as "AMSAT-NA" where the "NA" indicates North America.

Whenever the term AMSAT-NA is used in this document, it refers to the USA chartered Radio Amateur Satellite Corporation.

IARU works closely with AMSAT organisations throughout the world in many ways. Among these are the IARU International Satellite Forum, the IARU Satellite Advisor, and the IARU AMSAT Frequency Co-ordinator.

II. PURPOSE OF THIS PAPER.

This paper is offered by IARU and AMSAT organisations world-wide to aid prospective owners and operators of satellites planned to operate in frequency bands allocated to the amateur-satellite service. Originally prepared by AMSAT-NA for use in North America, it was adapted for international use and approved by the IARU International Satellite Forum in 1997.

III. DEFINITIONS.

Special terms for frequency management are defined in treaties which are honoured by nearly every national government and operating agency in the world.

Although these terms are used in everyday language, whenever these special terms are used here, they are used with the meanings established in the treaties.

A list of many of these important frequency management terms and definitions is in Annex I. Citations used are explained in Annex II.

Here are two very important definitions, which will be cited frequently throughout this paper.

"Amateur Service: A radiocommunication service for the purpose of self-training, intercommuni-cation and technical investigations carried out by amateurs, that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest." [RR S1.56]

"Amateur-Satellite Service: A radiocommunication service using space stations on earth satellites for the same purposes as those of the amateur service." [RR S1.57]

IV. TREATY REQUIREMENTS.

Members of the ITU have obligated themselves to maximise the use of the radio frequency spectrum and to minimise interference. The treaties are the legal basis for administrations to regulate the amateur service and amateur-satellite service.

Extracts from treaty documents describing some basic principles of world frequency management, the amateur service, and the amateur-satellite service follow. Members of the International Telecommunication Union [ITU] have agreed, among other things, that the Administrative Regulations, including the Radio Regulations "regulate the use of telecommunications and shall be binding on all Member States... ." [CS 31]

"Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations ... or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations." [RR S4.4]

"When transmissions between amateur stations of different countries are permitted, they shall be made in plain language and shall be limited to messages of a technical nature relating to tests ... ." [RR S25.2]

"Space stations in the amateur-satellite service operating in bands shared with other services shall be fitted with appropriate devices for controlling emissions in the event that harmful interference is reported ... . Administrations authorising such space stations shall inform the [Radiocommunication] Bureau and shall ensure that sufficient earth command stations are

established before launch to guarantee that any harmful interference which might be reported can be terminated by the authorising administration ... ." [RR S25.11]

V. INTERNATIONAL FREQUENCY COORDINATION AND NOTIFICATION.

Co-ordination and notification are the processes used to minimise the chances of causing interference to other amateur stations and amateur-satellite stations and to stations of other Radiocommunication services.

A. International Co-ordination. Many different and, often, incompatible operations are conducted in amateur service and amateur-satellite service frequency allocations. To help minimise interference, band plans are drawn up by co-operating amateur groups.

World amateur band plans are recommended by the International Amateur Radio Union (IARU), the international federation of national amateur radio organisations. Amateur satellite organisations, including AMSAT-NA, work in close co-operation with the IARU through the IARU Satellite Advisor and IARU AMSAT Frequency Co-ordinator.

Those contemplating the construction of a satellite to operate in the amateur-satellite service should contact their nearest AMSAT organisation for assistance early in the planning stage of the project. If you do not know how to do this, the IARU AMSAT Frequency Co-ordinator, or the IARU Satellite Advisor, can aid you in this. The Co-ordinator's primary function is to assist in the planning of operating, control, and telemetry frequencies for best results in conjunction with other amateur satellites as well as terrestrial operators around the world. The Advisor's primary function is to keep the IARU Administrative Council, its principal administrative body, informed of matters affecting the amateur-satellite service. Information about contacting the IARU Satellite Advisor and IARU AMSAT Frequency Co-ordinator is in Annex III.

B. International Notification. Administrations are obligated by treaty to notify the ITU Radiocommunication Bureau of proposed amateur-satellite stations in advance of launch whenever co-ordination of the use of frequencies will be required with stations in other radio services. [See RR Article S9, RR Article S11, RR S25.11, and RR Appendix S4.]

Frequency allocations to the amateur-satellite service which are shared with other services are the bands 435 - 438 MHz, 1 260 - 1 270 MHz, 2 400 - 2 450 MHz, 3 400 - 3 410 MHz (available in Regions 2 and 3 only), 5 650 - 5 670 MHz, 5 830-5 850 MHz, 10.45 - 10.5 GHz, 76 - 81 GHz, 144 - 149 GHz, and 241 - 248 GHz.

If amateurs in more than one country are involved in the project, a single country of license must be agreed upon and the appropriate arrangements for notification made through its administration.

Formal ITU notification is not required for the use of bands allocated to the amateur service and amateur-satellite service exclusively. Even so, international notification of the use of frequencies in exclusive bands is good advertising directed to administrations world-wide. (Administrations generally determine how votes are cast at World Radiocommunication Conferences.) The future of the amateur service and the amateur-satellite service depends upon these people seeing that there is value in maintaining their allocations.

VI. OPERATIONAL GUIDELINES.

The following operational guidelines, based on interpretations by IARU of the Radio Regulations and good amateur practice, are intended to help in planning the missions, management, and control of satellites planned to operate in the amateur-satellite service.

Organisations building satellites should compare their mission plans to the requirements of the amateur-satellite service. Then, they should determine if it is possible to comply with the requirements of the amateur-satellite service or if licensing and operation should be in some other radio service which is more consistent with the nature and requirements of the mission.

A. The purposes of an amateur satellite should be:

(1) To provide communication resources for the general amateur radio community and/or

(2) To conduct technical investigations in all respects consistent with the Radio Regulations. [See RR S1.56 and RR S1.57.]

Technical investigations carried out using frequencies allocated to the amateur-satellite service should be relevant to the development of "radio technique," that is, have a reasonable possibility of application to the development of radio communication systems. [See RR S1.56 and RR S1.57.]

Examples of such technical investigations include: propagation studies, operational analysis of protocols used for digital voice and data communication, development of attitude determination methods, development of command and control procedures, studies of radiation effects on various electronic components, studies of meteor trail reflection, and measurement of the orbital environment useful in designing future amateur satellites.

While many other types of technical investigations are conceivable, those not having a reasonable possibility of application to radio communication systems are probably not in accordance with the treaty requirements. An administration can reject whatever it decides is inappropriate use of the amateur-satellite service or questions may be raised by other administrations.

B. Station Control.

All stations operating in the amateur service and the amateur-satellite service, including space and Earth stations, must be controlled by "duly authorised persons," that is, licensed amateur radio operators who must be acting "solely with a personal aim and without pecuniary interest." [See RR S1.56 and RR S1.57.]

Even with these limitations, organisations and amateurs have common interests and work together for their mutual benefit. (For this discussion, an organisation can be a university, research institute, for-profit or not-for-profit corporation, association, club, or other similar entity.)

AMSAT-NA, for example, is an organisation which owns and builds space stations to operate in the amateur-satellite service. But, because it is an organisation and not an individually licensed radio amateur, it may not control an amateur station. Licenses under which AMSAT-

NA owned amateur stations are operated are issued either in the name of an individually licensed amateur radio operator or an amateur radio club (in this case, AMSAT-NA itself) where a licensed amateur radio operator is named on the license as trustee (the person responsible) for the club station.

In every case, an individual licensed amateur radio operator, who is neither employed nor paid by AMSAT-NA, is legally responsible for the operation of every amateur station or amateur-satellite station.

Commonly, the licensee is an unpaid member of the organisation which owns the amateur station equipment or is a volunteer acting in close association with it. In these cases, the owner's interest and the licensee's "personal interest" are usually the same.

Of course, it is theoretically possible (although to the best of our knowledge, it has never occurred in practice) that the licensee or trustee of an amateur station or amateur-satellite station may determine that something he or she has been requested to do is not in accordance with the rules and regulations of his/her administration. If this happens, the licensee would inform the organisation and, if possible, they would work out a solution that satisfies and protects both.

Thus, the individual responsibility of the licensed amateur radio operator, effectively imposed by the Radio Regulations, works as a kind of legal safety check for the organisation and the amateur to protect both of their interests as well as that of the amateur-satellite service itself.

This arrangement has worked successfully and effectively for AMSAT-NA and its predecessor organisations since the first amateur satellite (OSCAR-1) in 1961.

C. Multi-service Satellites. A "multi-service satellite" is a space station which operates in frequency bands allocated to the amateur-satellite service and one or more additional satellite services. Even though the space station is part of a shared platform, all operation on frequencies allocated to the amateur-satellite service must meet the requirements of the amateur-satellite service.

Transmissions in frequency bands allocated to the amateur-satellite service should not be used, for example, for routine telecommand, telemetry, or other operation involving the portion which is in another service. [See RR S1.56 and RR S1.57.]

D. Plain Language. The amateur-satellite service, by its nature, involves stations of more than one country. International communication between amateur stations in different countries must be in plain language. [See RR S25.2.] The plain language requirement includes telemetry and data exchanged between users.

To meet the plain language requirement, technical descriptions of all emissions, codes, and formats must be made publicly available. No system intended to conceal the meaning of a transmission may be used.

Publication can be in a variety of ways. Use the amateur radio press: The AMSAT Journal published by AMSAT-NA, OSCAR News from AMSAT-UK, or AMSAT-DL News; or, general circulation periodicals such as QST, CQ, or Radio Communication. Use electronic publications: AMSAT-BB reaches around the world quickly and cheaply. AMSAT-NA world

wide web and FTP sites are accessible world-wide. Whenever possible, publish prior to launch or as soon as possible thereafter. For more information about electronic publishing, see Annex IV.

NOTE: Space telecommand transmissions for critical spacecraft functions are generally accepted as exempt from the requirement to use plain language.

E. Open Access. All telecommunication facilities, except telecommand, operating in amateur-satellite service allocations should be open for use by amateur radio operators world-wide. All experiments utilising frequencies allocated to the amateur-satellite service should be freely available for use by radio amateurs world-wide and for reception by students and educators.

F. Broadcasting. The broadcasting service is "a radiocommunication service in which the transmissions are intended for direct reception by the general public." [See CS/An. 1010.] Broadcasting is not a function of the amateur service or of the amateur-satellite service and is, therefore, not permitted. However, the transmission of bulletins and data intended for reception by licensed amateurs is not considered broadcasting nor are other types of messages intended primarily for licensed amateurs which may also be received by non-amateurs.

VII. PUBLIC RELATIONS.

Public announcements, press releases, and other public relations items concerning satellites to be operated in the amateur-satellite service are valuable tools for maintaining frequency allocations for the amateur service and amateur-satellite service and stimulating interest in amateur radio. Frequency allocations are highly contested. Those voting at World Radiocommunication Conferences must be kept aware of how the amateur-satellite service benefits the people of their countries. Direct contact with administration officials is very important, should be sought, well planned, and well maintained.

Good public relations help amateur radio grow better. More exposure of the amateur service and amateur-satellite service will attract more people to amateur radio. Everyone benefits from the influx of new members into the amateur radio community.

VIII. CONCLUSION.

Good planning of an amateur-satellite project requires care and appropriate clear objectives to assure the success of the project. IARU and AMSAT organisations world-wide provide this information in order to help prospective amateur-satellite builders achieve their goals.

For more information, contact your nearest AMSAT organisation, the IARU Satellite Advisor or the IARU AMSAT Frequency Co-ordinator (See Annex III).

Annex I. DEFINITIONS.

These definitions are from the Constitution (CS) of the International Telecommunication Union (ITU), amended Minneapolis, 1998; and the Radio Regulations (RR), Geneva, 1998.

"Member States and Sector Members shall have the rights and shall be subject to the obligations provided for in this Constitution and the Convention." [CS 24]

"Administration: Any governmental department or service responsible for discharging the obligations undertaken in the Constitution of the International Telecommunication Union, in the Convention of the

International Telecommunication Union and in the Administrative Regulations." [CS/An. 1002]

"Allocation (of a frequency band): Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space radiocommunication services or the radio astronomy service under specified conditions. This term shall also be applied to the frequency band concerned." [RR S1.16]

"Allotment (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space radiocommunication service in one or more identified countries or geographical areas and under specified conditions." [RR S1.17]

"Assignment (of a radio frequency or radio frequency channel): Authorisation given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions." [RR S1.18]

"Radiocommunication service: A service as defined in this Section [of the Radio Regulations] involving the transmission, emission and/or reception of radio waves for specific telecommunication purposes. [RR S1.19]

"Amateur Service: A radiocommunication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest." [RR S1.56]

"Amateur-Satellite Service: A radiocommunication service using space stations on Earth satellites for the same purposes as those of the amateur service." [RR S1.57]

"Station: One or more transmitters and receivers or a combination of transmitters and receivers, including the accessory equipment, necessary at one location for carrying on a radiocommunication service, or the radio astronomy service. Each station shall be classified by the service in which it operates permanently or temporarily." [RR S1.61]

"Earth station: A station located either on the Earth's surface or within the major portion of the Earth's atmosphere and intended for communication:

- with one or more space stations; or
- with one or more stations of the same kind by means of one or more reflecting satellites or other objects in space." [RR S1.63]

"Space station: A station located on an object which is beyond, is intended to go beyond, or has been beyond, the major portion of the Earth's atmosphere." [RR S1.64]

"Telemetry: The use of telecommunication for automatically indicating or recording measurements at a distance from the measuring instrument." [RR S1.131]

"Space Telemetry: The use of telemetry for the transmission from a space station of results of measurements made in a spacecraft, including those relating to the functioning of the spacecraft." [RR S1.133]

"Telecommand: The use of telecommunication for the transmission of signals to initiate, modify or terminate functions of equipment at a distance." [RR S1.134]

"Space telecommand: The use of radiocommunication for the transmission of signals to a space station to initiate, modify or terminate functions of equipment on an associated space object, including the space station." [RR S1.135]

Annex II. CITATIONS AND FINDING IMPORTANT DOCUMENTS.

Citations explained.

CFR Code of Federal Regulations, National Archives and Records Administration (USA). Specific rules and regulations are cited using the title number, then "CFR", then the specific rule provision. "Title 47-TELECOMMUNICATION" contains all rules and regulations of Federal Government agencies and departments (including FCC) on the subject of telecommunication.

CS Constitution of the International Telecommunication Union (ITU), amended Minneapolis, 1998. Specific provisions are cited as "CS" followed by the provision number from the left hand margin of the document.

RR Radio Regulations, Geneva, 1998. Specific provisions are cited as "RR" followed by the provision number from the left hand margin of the document.
Finding these documents.

CFR and other USA Government publications are available in most libraries in the USA and at major libraries in many countries (ask the reference librarian). Also, copies are available in United States Information Agency (USIA) libraries at embassies and consulates around the world. Copies of individual volumes in the CFR series can be purchased from the Superintendent of Documents, US Government Printing Office, Mail Stop SSOP, Washington, DC 20402-9328 USA, telephone: +1 (202) 783-3238. CFR are also available on the World Wide Web at http://www.access.gpo.gov/nara/index.html.

ITU Convention and Constitution, Radio Regulations, and other ITU documents are distributed to administrations of Member States and recognised operating agencies. Copies can be purchased from the International Telecommunication Union, ITU Sales Service, Place des Nations, 1211 Geneva 20, Switzerland; TELEFAX: +41 22 730 51 94. For additional information including a complete catalogue of documents, check the ITU GOPHER server [ties.itu.ch] or web server [http://www.itu.ch/] providing ITU Telecom Information Exchange Services (TIES).

Annex III. IARU CONTACTS.

IARU AMSAT Frequency Coordinator:
Graham Ratcliff, VK5AGR

9 Homer Road
Clarence Park
5034 Adelaide SA
Australia
E-mail: vk5agr@amsat.org
Telefax: +61 8 204 7100
IARU Satellite Advisor:
Hans van de Groenendaal, ZS5AKV
PO Box 1842
3650 Hillcrest
Republic of South Africa
E-mail: zs5akv@amsat.org
Telefax: +27 31 765 6456
The International Amateur Radio Union
International Secretariat
P.O. Box 310905
Newington, CT 06131-0905 USA
E-mail: iaru@iaru.org
Telephone: +1 (860) 594-0200
Telefax: +1 (860) 594-0259

Annex IV. ELECTRONIC PUBLICATION.

AMSAT-NA publishes information through its world wide web server [http://www.amsat.org/] and its FTP site [ftp://ftp.amsat.org/].