Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Service Rules and Procedures to Govern the Use	)	
of Aeronautical Mobile Satellite Service Earth	)	IB Docket No. 05-20
Stations in Frequency Bands Allocated to the	)	
Fixed Satellite Service	)	

COMMENTS OF THE
NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

The National Academy of Sciences, through the National Research Council's Committee on Radio Frequencies[1] (CORF), hereby submits its comments in response to the Commission's February 9, 2005, Notice of Proposed Rulemaking in the above-captioned docket (NPRM). In these comments, CORF discusses the importance to the Radio Astronomy Service (RAS) of observations at 14.47-14.50 GHz and supports the Commission's proposals to protect RAS observations in this band with coordination requirements and with a revised footnote in the Table of Allocations.

I. Introduction: The Role of Radio Astronomy, the Unique Vulnerability of Passive Services to Interference, and the Importance of Observations in the 14.47-14.50 GHz Band.

CORF has a substantial interest in this proceeding, because it represents the interests of the passive scientific users of the radio spectrum, including users of the RAS bands. RAS observers perform important yet extremely vulnerable research.

As the Commission has long recognized, radio astronomy is a vitally important tool used by scientists to study our universe. Radio astronomy provided the first evidence for planets outside the solar system, circling a distant pulsar. Measurements of radio spectral line emissions have identified and characterized the birth sites of stars in our own galaxy and the complex distribution and evolution of galaxies in the universe. Radio astronomy measurements have discovered ripples in the cosmic microwave background that were imposed on the signals by acoustic vibrations of the early universe, which evolved into today's stars and galaxies. Observations of supernovas have allowed us to witness the creation and distribution of heavy elements essential to the formation of planets such as Earth, and of life itself.

It is important to remember that the frequencies at which radio astronomers observe are dictated by the laws of nature. Furthermore, the emissions that radio astronomers receive at these frequencies are extremely weak. Because radio astronomy receivers are designed to pick up such remarkably weak signals, such facilities are particularly vulnerable to interference from spurious and out-of-band emissions from licensed and unlicensed users of neighboring bands and those that produce harmonic emissions that fall into the RAS bands.

In addition to the gains in scientific knowledge that result from radio astronomy, CORF notes that such research spawns technological developments that are of direct

[1] A roster of the committee is given in the attachment.

and tangible benefit to the public. For example, radio astronomy techniques have contributed significantly to major advances in the following areas:

— *Computerized tomography* (CAT scans) as well as other technologies for studying and creating images of tissue inside the human body;

— Increasing abilities to *forecast earthquakes* by the use of very-long-baseline interferometric (VLBI) measurements of fault motions; and

— Use of VLBI techniques in the development of *wireless telephone geographic location technologies*, which can be used in connection with the Commission's E911 requirements.

Continued development of new critical technologies from passive scientific observation of the spectrum depends on scientists having ongoing access to interference-free spectrum. More directly, the underlying science undertaken by radio astronomy observers cannot be performed without access to interference-free spectrum. Loss of such access constitutes a loss for all people of their scientific and cultural heritage, as well as the loss of practical applications from the information learned and the technologies developed.

Of particular importance in this proceeding are observations at 14.47-14.50 GHz. Radio astronomers make spectral line observations of formaldehyde in this band. The formaldehyde line with a rest frequency of 14.488 GHz is included in Table 1 of Recommendation ITU-R RA.314, which lists the radio frequency lines of greatest importance to radio astronomy. Formaldehyde is one of the primary molecules used in radio astronomy to study comets, star formation in our galaxy, the early stages of planet formation in disks around nearby stars, and the inner regions of distant galaxies, where disks of molecular material form and serve as fuel for quasars and related activity. The

relative populations of the *ortho*- and *para*-forms of this complex molecule provide important evidence of the astrochemical processes at work in the interstellar regions where the molecule is observed. Observations of formaldehyde in this frequency band are particularly useful for determining the density of interstellar molecular clouds. The formaldehyde molecule is also on the pathway to prebiotic molecules of intense interest to those scientists attempting to understand the origin of living organisms.

II. CORF Supports the Proposed Protections for RAS Observations.

As shown above, RAS observations at 14.47-14.50 GHz are important, and CORF is grateful that the Commission recognized that importance with proposals to protect RAS observations. See NPRM at paras. 28-30. CORF supports the proposed protections for RAS observations, as discussed below.[2]

A. Coordination

In paragraph 28 of the NPRM, the Commission proposes that as a prerequisite to licensing Aeronautical Mobile Satellite Service (AMSS) operations in the 14 GHz band, such operations be coordinated with the National Telecommunications and Information Administration (NTIA). CORF strongly supports the proposal that coordination through National Telecommunications and Information Administration (NTIA) be a *prerequisite for licensing*. As recognized in the NPRM, both the Boeing Company and Aeronautical

[2] For similar reasons, CORF also supports the proposals in the NPRM to require protection of Space Research Service operations at 14.0-14.2 GHz.

Radio, Inc. (ARINC) have entered into such coordination agreements,[3] and such coordination agreements do not constitute an unreasonable burden on use of AMSS.[4] CORF believes that enacting a rule to make coordination a condition of licensing serves the public interest by making the coordination requirement explicit. Furthermore, fairness requires that any future AMSS operator should have to meet the same requirement for coordination that Boeing and ARINC have already committed to.

In regard to the AMSS operations that would trigger a coordination requirement, the NPRM suggests (at para. 28) that operation within the "vicinity" of an RAS facility might trigger a requirement to cease AMSS operations, and that "vicinity" might best be defined as within the line of sight of the RAS facility. CORF agrees that in connection with coordination, it is the geographic area within *line-of-site of the protected RAS facility* where AMSS operations would have to cease,[5] per conditions of any coordination agreement.

In regard to the specific frequencies covered in a coordination requirement, the NPRM asks (at para. 28) whether the requirement should apply to the entire 14.0-14.50 GHz band, or only to the 14.47-14.50 GHz segment. Although the international

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[3] See NPRM at footnote 87, citing coordination agreements between the National Science Foundation (NSF) and Boeing, and between NSF and ARINC. The NSF is the lead federal agency charged with funding U.S. ground-based radio astronomy facilities.

[4] A coordination condition was recently placed on the grant of a 1.6 GHz MSS license to Mobile Satellite Ventures Subsidiary LLC (DA 05-1492, released May 23, 2005).

[5] This is the geographic area covered in the NSF/ARINC and NSF/Boeing coordination

allocation for RAS is from 14.47-14.50 GHz, Recommendation ITU-R M.1643 recommends protection of RAS observation throughout the entire 14.0-14.50 GHz band. CORF commends the Commission for recognizing the potential danger posed by out-of-band emissions from 14.0-14.47 GHz into the narrower protected allocation. Indeed, out-of-band emissions have been a primary source of interference to RAS observations in many bands, and CORF has a long history of urging the Commission to protect RAS facilities from the effects of out-of-band emissions. Optimal protection for RAS observations would require coordination of the entire 14.0-14.50 GHz band, however in this case if the Commission enacted rules providing AMSS facilities transmitting at 14 GHz must comply with the requirements of ITU-R M.1643, Annex ,1 Part C*,* then it would be acceptable *to require coordination of only the narrower 14.47-14.50 GHz segment*. This requirement would help to protect RAS observations because transmission facilities that comply with ITU-R M.1643 will have out-of-band emissions that are below detrimental levels.

The NPRM seeks comments on Boeing's suggestion that as part of the coordination process, RAS observatories should be required, when it is practical to do so, to provide advanced notification to AMSS operators of times of observation at 14.47-14.50 GHz. CORF believes that for the purposes specified for this band, a requirement that an RAS facility provide advanced notification of its observing schedule, when

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agreements.

practical, is acceptable.[6] CORF notes that, on occasion, there may be a need that cannot be anticipated long in advance to observe special transient celestial objects or phenomena. However, such needs are typically limited and have been accommodated in existing coordination agreements.

In paragraph 54 of the NPRM, the Commission seeks comments as to whether AMSS operators should be required to keep aircraft tracking data for a period of 1 year, and to make that data available to a limited number of parties when necessary to identify sources of interference. CORF supports such a requirement. The data obtained from radio astronomy observations are typically not reviewed by the astronomer in real-time, but rather, after the observation is performed. Accordingly, it is typically long after an observation is made that data suggesting an event of interference are discovered. Although the coordination requirements proposed by the Commission should be effective in preventing interference, in the case where interference to RAS observations occurs, aircraft tracking data would be needed to determine whether the source of interference was a particular AMSS operation.

B. Protected Observatories and Footnote US203

In paragraph 33 of the NPRM, the Commission seeks comments on whether the

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[6] Observing time at major RAS facilities is typically granted to projects reviewed favorably by external referees, solely on the basis of scientific merit. Therefore, prior to the proposal deadline, an RAS facility typically can neither predict nor modify the total number of observing hours in any band during a particular scheduling period, as this is set by proposal pressure and the reviewers. Nothing in any coordination requirement or agreement should be construed as restricting or limiting an observatory's ability to accept and review proposals, and to grant observing time solely on the basis of scientific merit.

list of RAS observatories in Footnote US203 should be modified to more accurately reflect the facilities where observations at 14.47-14.50 GHz are being made, and thus should be protected. Footnote US203 currently states that observations at 14.47-14.50 GHz are made at RAS sites at Green Bank, West Virginia; Socorro, New Mexico; Hat Creek, California; Tyngsboro, Massachusetts; Big Pine, California; and Amherst, Massachusetts. As suggested in paragraph 33 of the NPRM, that list is outdated. Observations at 14.47-14.50 GHz are no longer made at the Hat Creek, Tyngsboro, or Amherst sites. However, observations also are or can be made at other major RAS sites not currently listed in US203, specifically the Arecibo, Puerto Rico,[7] and the Very Long Baseline Array (VLBA) sites listed in paragraph 33 of the NPRM. Protection for these facilities is thus necessary. Accordingly, CORF recommends that *Footnote US203 be modified to reflect the sites listed in the NSF/Boeing Agreement*, as set forth in paragraph 33 of the NPRM.

In paragraph 29 of the NPRM, the Commission seeks comments as to whether, and if so how, AMSS operators should coordinate with future RAS sites. The Commission notes that if coordination is limited to sites in Footnote US203, modification of the footnote to add sites would be subject to a notice and comment rulemaking procedure, which can take a long time to complete. CORF shares this concern with the Commission. While CORF is pleased that there is an opportunity to revise Footnote

[7] While Footnote US203 states that observations of formaldehyde are made at Arecibo, Puerto Rico, only at 4 GHz, CORF understands that there are proposals to upgrade the facilities of the Arecibo Observatory to make observations possible at up to 15 GHz.

US203 in the context of this proceeding, and CORF supports that revision, CORF also supports the Commission's proposal that future sites be coordinated on an ad hoc basis, at least until there is an opportunity to modify Footnote US203 to add the future sites. Thus, while CORF does not anticipate a large number of such new sites in the future, it is proper for the Commission to provide for the protection of any such sites pending future modification of Footnote US203. CORF suggests the following approach: At least 6 months before a new RAS site that observes at 14.47-14.50 GHz becomes operational, the NTIA or the NSF would notify the Commission's International Bureau, which would then issue a Public Notice requiring Ku-band operators to complete coordination of their operations with the new facility prior to commencement of operations at the new RAS site. This approach is analogous to the Commission's proposal for future tracking and data relay satellite system (TDRSS) sites, set forth in paragraph 24 of the NPRM.[8] In conjunction with this ad hoc coordination process, either the observatory could file a petition for rulemaking to modify Footnote US203, or the Commission could propose such a modification on its own motion.

In paragraph 28 of the NPRM, the Commission seeks comments as to whether secondary status should be granted to the RAS for the 14.0-14.47 GHz portion of the band. As previously stated, CORF commends the Commission for recognizing the

[8] The Commission has the authority to require such ad hoc coordination under its general Title III powers to regulate radio transmissions, and it would serve the public interest to do so, for the very same reasons that it serves the public interest to require coordination through the provisions of Footnote US203, i.e., that doing so protects important scientific research.

potential danger posed by out-of-band emissions from 14.0-14.47 GHz into the narrower protected allocation. However, while CORF does not oppose such additional secondary status, if the Commission enacts rules requiring AMSS facilities transmitting at 14 GHz to comply with the requirements of ITU-R M.1643, Annex 1, Part C, then CORF does not believe that creation of secondary status in the 14.0-14.47 GHz segment will be necessary to protect RAS observations, because transmission facilities that comply with ITU-R M.1643 will have out-of-band emissions that are below detrimental levels.

III. Conclusion.

It is important to protect RAS observations at 14.47-14.50 GHz, and accordingly CORF supports the Commission's proposals to protect such observations in this band with coordination requirements described above, and with a revised Footnote US203.

Respectfully submitted,

NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

By: /s/
Bruce Alberts
President

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Direct Correspondence to:

CORF
Keck Center of the National Academies
500 Fifth St., NW, MS W922
Washington, DC 20001
(202) 334-3520

Attachment A

CORF Membership List:

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