



Commission GASS 2021 Report

Commission J

The Commission J business meeting at GASS 2021 was held during three scheduled sessions on 30 August, 1 September, 3 September, 2021

Attendees

On-site: Pietro Bolli, Max Hawkins, Alex Kraus, Gundolf Wieching, Stefan Wijnholds

Online: Willem Baan, Richard Bradley, Douglas Bock, Claudia Cicone, Les Deutsch, Jacki Gilmore, Assaf Horesh, Lucas Hunt, Devoiyoti Kansabank, Brian Kent, Yuri Kovalev, Joseph Lazio, Michael Lindqvist, Hiroshi Matsuo, Vanessa Moss, Ann Njeri, Sara Salem, David Skellern, Melissa Soriano, Jan-Willem Steeb, Tasso Tzioumis, Sravani Vaddi, Jeff Wagg.

1. Results of Election of Vice-Chair

Prof. Stefan J Wijnholds (ASTRON, Netherlands) was elected Vice-Chair from the end of GASS 2021 until the end of GASS 2023, in a process overseen by the URSI secretariat.

2. Results of Election of Early Career Representative

Dr. Danielle Fenech (University of Cambridge, UK) was elected ECR representative from the end of GASS 2021 until the end of GASS 2026, in a process overseen by the URSI secretariat.

3. Appointment of Associate Editor for *Radio Science Bulletin*

Dr. Rich Bradley (National Radio Astronomy Observatory, USA) was the only nominee for the Commission J Associated Editor of the Radio Science Bulletin. Dr. Bradley was elected.

4. Updates/Status of Working Groups

The commission heard reports from three working groups. The commission also participates in the Interdisciplinary Space Weather WG (GJFEH) and the Computer Simulations in Space Plasmas WG (HJ).

RFI Mitigation and Characterization (FGHJ)

Chairs for Comm. F: A.K. Mishra (South Africa), D. Le Vine (USA) Chair for Commission G: T. Bullett (USA) Chair for Comm. H: H. Rothkaehl (Poland) Chairs for Commission J: R. Bradley (USA), W. Baan (Netherlands)

Willem Baan provided a brief update on the activities of the WG, which included an RFI workshop, and planning for the upcoming RFI 2022 workshop in February.

Interdisciplinary Space Weather (GJFEH)

Co-Chair for G: I. Stanislawska (Poland) Co-Chair for J: R. Fallows (Netherlands)

Written report was tabled (attachment 1)

URSI/IAU Inter-Union Working Group on Historical Radio Astronomy

Chair: Richard Schilizzi, Vice-Chair: Leonid Gurvits, Past Chair: Richard Wielebinski, Secretary: Ken Kellermann



Richard Schilizzi gave a presentation that reminded the commission of the goals of the WG, provided an update on its publications and conferences, and gave an overview of the memoirs added to the archive of the WG in the last triennium. The material of the WG is collected on <http://rahist.nrao.edu>. The working group intends to continue its activities in the next triennium and has, e.g., 10 books already in press or in preparation. The presentation was tabled (attachment 2).

URSI/IUCAF Inter-Union Working Group on Radio Science Services

Chair: H. Liszt (USA)

Harvey Liszt gave an update on the Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science (IUCAF). IUCAF was set up by URSI, IAU and COSPAR and is chartered by the ISC. He then went through the main points of the quadrennial report of WG over the period 2017-2021. A written report on IUCAF was tabled (attachment 3).

5. Updates to Terms of Reference of Commission

The current Terms of Reference were reviewed. No changes were proposed.

6. Meetings proposed to be supported in the coming triennium

The Commission will support RFI 2022 (14-18 February, Reading UK) with €600. Support for further meetings will be considered at URSI-AT in May, or between meetings as necessary, with a preference to support young scientists where possible.

7. Report and comments on the scientific program of the Commission for the current GASS

The scientific program was successful and well received. However, convenors had the impression that total (local and remote) participation in individual sessions was less than might have been expected in the traditional format. Possibly this is because people outside the European timezone joined only for key talks.

Commission J has had feedback that the cost charged for virtual participation is out of step with what is charged by other meetings attended by Radio Astronomers, and that convenors struggled to retain participants who were price-sensitive. Further, a “hybrid” format that requires most virtual participants worldwide to participate during the night for several days does not appear attractive in comparison to a virtual format that is timezone independent.

Commission J understands that some participants may be attracted by the possibility of a refereed IEEE Conference paper and willing to pay a higher registration fee on this basis. However, this does not appear to be a factor for Commission J authors. URSI may wish to consider a lower fee for those whose primary interest is sharing ideas with peers at the meeting and who do not publish in the proceedings.

One suggestion is to target some meetings (e.g. GASS) at in-person attendance (with “back up” virtual participation) while others (perhaps URSI-AT?) are entirely virtual with lower registration fees and a format conducive to multiple timezones. URSI may also wish to benchmark proposed future meetings against competing events such SPIE Telescopes and Instrumentation, the American Astronomical Society or the USNC URSI meeting in Boulder.

Detailed feedback on the meeting format has already been forwarded to the Secretariat by the outgoing Chair.

8. Proposed sessions for the next GASS

Preliminary list of topics (to be finalised, with convenors, at AT-RASC)

- New Telescopes



- Radio Astronomy from Space
- Single Dish Telescopes and Instrumentation
- Very Long Baseline Interferometry
- Antennas and Receivers
- Scientific data processing in Radio Astronomy
- Digital systems for Radio Astronomy
- One or two topical sessions on science themes and related techniques (HI, early universe, time-domain astronomy, etc)
- Mitigation of Radio Frequency Interference
- Latest News and Observatory Reports

9. Proposed sessions for the AT-RASC

The following sessions are proposed for AT-RASC

J01: New Telescopes (C. Ferrari, T. Bourke)

J02: VLBI (F. Colomer, T. Venturi)

J03: Time-domain astronomy - observations and instrumentation (S. Bhandari)

J04: Cosmological HI - observations and instrumentation (N. Razavi-Ghods, D. Price)

J05: Wide-field radio astronomy (G. Heald, D. Fenech, I. Prandoni)

J06: Space-based radio astronomy (M. Bentum, M. Klein Wolt)

J07: Calibration and instrumentation (T. Carozzi, J. Gilmore)

J08: CEM method for radio astronomy (P. Bolli, D.B. Davidson)

J09: Receiving systems and their components (E. De Lera Acedo, D. Prinsloo)

J10: Big Data and AI in radio interferometry (S.J. Wijnholds, U. Rau, G. Hellbourg, N. Gupta)

J11: Latest new and observatory reports (open session) (D. Bock, S.J. Wijnholds)

JE: EMC issues in integration of digital and analog electronics (C. Carobbi, K. Buch, A. Tzioumis)

JG: Mutual Benefit between radio astronomy and ionospheric science (M. Mevius, C. Cesaroni)

JH: Solar, heliospheric and planetary physics (P. Zucca, P. Galopeau)

10. Other business

The meeting

- Thanked Dr. Bradley and Prof. Wijnholds for their service as Chair and ECR representative, respectively, and welcomed the incoming officers.
- Supported the establishment of the URSI Women in Radio Science Committee and the opportunities for increasing diversity broadly in radio science.
- Discussed the hybrid format of the meeting and agreed that Dr. Bradley would provide feedback to URSI Presidency.
- Reviewed the existing arrangement whereby the Chair convening ad hoc specialise working groups as necessary and agreed this remained appropriate. A standing technical advisory committee is not required at this time.
- Noted that Commission J participated in drafting an URSI resolution to support the elimination of leap seconds to correct UT1 – UTC.

Report WG GJFEH Interdisciplinary Space Weather

Co-Chair for G: I. Stanislawska (Poland, stanis@cbk.waw.pl), Co-Chair for J: R. Fallows (Netherlands, fallows@astron.nl).

The advanced state of space physics as well as the progress of techniques and technology meant that the development of space weather gained new acceleration. Many phenomena having a significant impact on life on our increasingly-advanced technical civilization have proved to be predictable, forecast and mitigated. This indicated the need to undertake new research directions and intensify others, which, with access to improved, innovative tools and methods, have just become an additional impulse for development. So, recent years have seen an extremely offensive rise in space weather activity. This activity was also marked by the dynamic participation of URSI interdisciplinary Space Weather Working Group members in new bodies.

During the accounting period the members of the Inter-commissions GJFEH actively participated in Space Weather related organizations and associations, many international events (conferences, symposia, workshops) and organizations, also by publishing the results and conclusions:

- International Space Environment Service ISES
- COSPAR International Space Weather Action Teams (ISWAT)
- Horizon H2020, European Space Surveillance Tracking SST
- ESA Space Situation Awareness SSA
- WMO Inter-Programme Team on Space Weather Information, Systems and Services (IPT-SWeISS)
- International Space Weather Initiative
- Low-Frequency Array (LOFAR)
- PECASUS - Pan-European Consortium for Aviation Space weather User Services for ICAO

Programs and research conducted in many URSI Committees constitute our significant contribution to scientific and especially in operational works.

The Working group activity has concentrated on the three main subjects:

- new radio science tools for space weather,
- radio science challenges for space weather services,
- radio science in planetary exploration.

Full face-to-face meetings have been very limited, especially in the recent Pandemic period, where most meetings were held online. Nevertheless, an online Radio Heliophysics Catch-up meeting will be held on over 10-13 May in place of a more-formal physical meeting originally planned for December 2020.

This has attracted more than 100 registrations, with 21 submitted abstracts covering multiple aspects of radio research across the solar and heliosphere space weather domains.

The results of the work will be presented in aggregate at the GA 2020 workshop in Rome. This workshop is devoted to the novel radio science tools for space weather, radio science in planetary exploration and radio science challenges for space weather services.

Three Panels of experts, including 3 invited presentations in total, and related open discussion towards the three topics that are:

- NEW RADIO SCIENCE TOOLS FOR SPACE WEATHER

The aim of this panel is to bring together the scientists using new arrays for space weather purposes (e.g. radio astronomers) and space weather scientists, who may be unfamiliar with the capabilities of these new instruments, to discuss how they can best be used to advance space weather science, and to discuss how these instruments and dedicated space weather instrumentation can best support one another in their respective goals.

- RADIO SCIENCE CHALLENGES FOR SPACE WEATHER SERVICES

Knowledge of effects imposed by the space weather on current and new generation operational radio systems, the development and implementation of techniques to mitigate the deleterious effects of the space weather on such systems are the primary scientific goals. The main issue to discuss within this panel is the generation of the novel directions for services to approach current and future radio science challenges.

- RADIO SCIENCE IN PLANETARY EXPLORATION

Since the start of the space venture fifty years ago, the interest of the effects of the space weather on the space missions and human exploration has strongly raised. Among the many diagnostic capabilities, radio experiments have proven to be very efficient both for remote and in-situ exploration. The aim of this panel is thus to bring together researchers from planetary and interplanetary past and future missions as well as engineers from radio domains to discuss the results of recent missions (like Mars Express) and address the results foreseen by the future, Solar Orbiter, Parker Solar Probe or Juice.

Résumé will be presented along with the perspective of challenges in this workshop.

IAU-URSI Working Group Historical Radio Astronomy

Report to Commission J
URSI General Assembly
1 September, 2021

Richard Schilizzi, Univ. Manchester
Leonid Gurvits, JIV-ERIC
Ken Kellermann, NRAO
Tim Robishaw (DRAO)
Richard Wielebinski, MPIfR

WG HRA first established in 2003 in the IAU, but since 2014 is a joint WG with URSI

1. Maintain an on-going bibliography of publications on the history of radio astronomy;
2. Commission and maintain online publication of biographical memoirs for deceased radio astronomers;
3. Encourage research relating to the history of radio astronomy, including the origins and development of current and past large facilities.

All documented on the WG website <https://rahist.nrao.edu>

Publications (2017-2021)

Year	Journals	Books	PhD theses
2017	11	4	1
2018	9	2	
2019	10	2	
2020	6	1	
2021			1
1958-2020	286		
1963-2020		43	
2008-2021			4

Conferences (2017-2021)

- 2017 The history of large radio interferometer projects and lessons learned, *URSI GASS*, Montreal (11 talks)
- 2018 The history of large single dish projects and lessons learned, *IAU GA*, Vienna (8 talks)
- Jas Fest: A Celebration of Jasper Wall at 75, Univ British Columbia, Vancouver (25 talks)
- 2019 The History of the Square Kilometre Array, 1980s-2012, *SKAO*, Jodrell Bank (49 presentations and 7 discussion sessions)
- 2021 The impact of radio astronomy on technology and society, *URSI GASS 2021*, session J09, 2 September, 13.50-16.00 (5 talks)

Biographical Memoirs 2017-2021

Wilhelm Altenhoff (2017)	Jet Katgert (2020)	John Sieradakis (2020)
Bryan Anderson (2020)	Pierre Kaufmann (2017)	Sue Simkin (2021)
Bernie Burke (2018)	Adair Lane (2017)	Lew Snyder (2021)
Diego Cesarsky (2021)	Ed Lilley (2020)	Roman Sorochenko (2017)
Nichi D'Amico (2020)	Roger Linfield (2020)	Govind Swarup (2020)
Ger de Bruyn (2017)	Jean-Pierre MacQuart (2020)	George Swenson (2017)
Bill Dent (2020)	Leonid Matveyenko (2019)	Yervant Terzian (2019)
Boris Dubinsky (2019)	Nguyen Quang Rieu (2021)	Pat Thaddeus (2017)
Paul Feldman (2020)	Kartarzyna Otmianowska-Mazur (2020)	Hugo van Woerden (2020)
Dick Hunstead (2020)	Eugen Preuss (2017)	Mario Vigotti (2021)
May Arif Kaftan-Kassim (2020)	Lee J. Rickard (2017)	Malcolm Walmsley (2017)
Nikolai Kardashev (2019)	Kristen Rohlfs (2017)	Harold Weaver (2017)

WG HRA Web site

<http://rahist.nrao.edu/>

- Membership
- Working Group Meetings and Reports
- Grote Reber Medalists
- Biographical Memoirs
- Resources – History of Radio Astronomy
 - Publications
 - Archives including URSI Commission 5/J and IAU Commission 40/B4 triennial reports
 - Individual astronomers
 - Workshops
 - Early radio astronomy courses
 - Recognised historic radio telescopes

Recognised Historic Radio Telescopes



- Bell Labs 20-foot horn antenna (1989, USA)
- Reber 11m (1990, USA)
- Stockert 25m (1999, Germany)
- Dwingeloo 25 m (2007, NL)
- Arecibo (2008, Puerto Rico)
- Jodrell Bank Observatory (2019, UK)
- 6 m Millimeter Radio Telescope (2019, Japan)
- Parkes 64 m (2020, Australia)

WG Officers

	2017-2021	2021-2024
Chair	Richard Schilizzi (UManchester)	Leonid Gurvits (JIV-ERIC)
Vice Chair	Leonid Gurvits	Tim Robishaw (DRAO)
Secretary	Ken Kellermann (NRAO)	Ken Kellermann
Past Chair	Richard Wielebinski (MPIfR)	Richard Schilizzi
Web Manager	Ellen Bouton (NRAO)	Ellen Bouton

Current WG membership: 46

- Includes 14 “national reporters” responsible for keeping track of developments of relevance to the WG in their respective countries or regions

The WG is completely open for anyone to join

Current and Future Activities

- Research → journal publications, books, PhD theses
- Maintenance and further development of the HRA WG
Web site <http://rahist.nrao.edu/>
- “Gone but not forgotten radio telescopes”
 - a list of other “gone but not forgotten” radio telescopes that have not had formal national or international recognition. These are defined as telescopes that no longer exist or are no longer in use for radio astronomy.
- Conference: **URSI GA August 2021, session J09**
- 10 books in press or in preparation

Books in press or in preparation

- 1) “History of the Arecibo Observatory” [Campbell D.](#)
- 2) “From the Sun to the Cosmos, J. L. Pawsey” [Goss, W.M., Ekers, R.D., and Hooker, C.](#) (in press, Springer, Open Access)
- 3) “Why don't you build a radio telescope?: 40 years of Radio Astronomy in Bologna” [Gregorini, L., Feretti, L., Giovannini, G., Mantovani, F., Parma, P., and Vettolani, G](#) (in press, Bologna University Press). English translation in preparation.
- 4) “Space VLBI – Radio telescopes Larger than the Earth” [Gurvits, L.I., Hirabayashi, H. and Schilizzi, R.T](#)(to be published by Springer)
- 5) “Star Noise: Discovering the Radio Universe” [Kellermann, K.I. and Bouton, E.N.](#) (to be published by CUP)
- 6) “The Square Kilometre Array: a science mega-project in the making, 1993-2012” [Schilizzi, R.T., Ekers, R.D., Crosby, P., and Dewdney, P.E.D.](#)“ (to be published by Springer, Open Access)
- 7) “History of the Max Planck Institute for Radio astronomy” [Schwartz, R. and Zensus, J.A](#) (English translation)
- 8) “The ALMA Radio Telescope - Birth Pangs of a Megaproject” [Vanden Bout, P. and Dickman, R.](#)
- 9) “A Young Science in a Young Country: The Origins and History of Canadian Radio Astronomy” [Wall, J.V., Griffin, E., and Jarrell, R.](#) (to be published by Springer)
- 10) “The Golden Years of Australian Radio Astronomy – An Illustrated History ” [Orchiston, W., Robertson, P., and Sullivan, W.](#)

Quadrennial Report 2017-2021

IUCAF

THE SCIENTIFIC COMMITTEE ON FREQUENCY ALLOCATIONS FOR RADIO ASTRONOMY AND SPACE SCIENCE (IAU - URSI – COSPAR and ISC)

1. INTRODUCTION

IUCAF's Annual Reports are regularly published in the URSI Radio Science Bulletin; for 2017 see RSB #364 (March 2018); for 2018, RSB #370 (September 2019); for 2019, RSB #371 (December 2019). The Annual Report for 2020, in press, can be found at ftp://ftp.cv.nrao.edu/NRAO-staff/hliszt/URSI/IUCAF-AnnualReport2020_Final.docx.

The Annual Reports describe IUCAF member attendance at innumerable ITU-R and other spectrum regulatory and other meetings. After a brief overview of IUCAF, the focus here will be on a few major activities that came to fruition since 2017.

2. ABOUT IUCAF

The Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science, IUCAF, originally the Inter-Union Committee on Allocation of Frequencies, was formed in 1960 by its adhering Unions, IAU, URSI, and COSPAR at the behest of URSI. IUCAF celebrated its 60th anniversary during the spectrum management school that was held during this period and is described below. IUCAF is online at <http://www.iucf.org>.

IUCAF operates as an Inter-Disciplinary Body under the auspices of the International Science Council. Its brief is to study and coordinate the requirements of radio frequency spectrum allocations for passive radio sciences (radio astronomy, space research and remote sensing) and to make these requirements known to national/international bodies that regulate use of radio spectrum. Its terms of reference, composition and operating practices can be found at http://www.iucf.org/IUCAF_Terms_Of_Reference.pdf.

The IUCAF membership from the three adhering Unions is:

URSI:	Dr. Haiyan Zhang	China
	Dr. Steven Reising	USA
	Dr. Ingemar Häggström	Sweden
	Dr. Anastasios Tzioumis	Australia
	Dr. Wim van Driel	France
IAU:	Dr. Harvey Liszt (Chair)	USA
	Dr. Masatoshi Ohishi	Japan
	Dr. Adrian Tiplady	South Africa
COSPAR:	Dr. Yasuhiro Murata	Japan
Ex-officio	Dr. Vadim Nozdrin	ITU-R SG7

IUCAF is a Sector Member of the International Telecommunication Union's Radiocommunication Sector (ITU-R) with observer status at the Space Frequency Coordination Group (SFCG) where, since May 2021, it participates in the Lunar Martian

Steering Group. IUCAF members participate in the activities of many other national and regional spectrum management bodies as noted in the Annual Reports.

3. 94 GHZ COORDINATION AGREEMENT WITH ESA

Since 2005, JPL has operated the 94.05 GHz CloudSat cloud profiling radar in the middle of a broad swath of spectrum that is allocated to and heavily used by radio astronomy. The powerful beam of this nadir-pointing radar saturates any receiver over which the satellite passes during its 16-day repeating orbital cycle, independent of the radio astronomy antenna pointing. More seriously, the radar could burn out the radio astronomy receiver in the worst case. A variety of modifications to radio astronomy operations and instruments have been made on this account, especially for moveable array antennas that are transported in a zenith-pointing orientation with their supercooled electronics operating.

To forestall this situation when ESA, with JAXA participation, launches the EarthCare mission in 2023 with an even higher-power 94.05 GHz radar, IUCAF has for many years participated in SFCG meetings where EarthCare was discussed. This 15-year effort bore fruit in April 2021 when ESA and IUCAF signed a Memorandum of Understanding under which the nadir-pointing EarthCare radar will be silenced when its beam passes close enough to a radio astronomy antenna that the radio astronomy receiver could be damaged.

IUCAF is grateful to ESA for agreeing to modify the EarthCare radar's operation, and to JAXA for designing the radar in such a way that such an accommodation was possible.

4. THE FIFTH INTERNATIONAL IUCAF SCHOOL ON SPECTRUM MANAGEMENT FOR RADIO ASTRONOMY AND OTHER OUTREACH

IUCAF maintains its World Map of Radio Astronomy Sites and Radio Quiet Zones that has been viewed 64,200 times, see <http://tinyurl.com/yrvszk>. IUCAF distributed its exceptionally popular IUCAF-logo fidget spinner, thanks to a continuing grant from an anonymous donor.



IUCAF's main outreach activities have been the international spectrum management schools it organized in 2002 (Green Bank, West Virginia, USA), 2005 (Castel San Pietro Terme, Italy), 2010 (Mitaka, Japan) and 2014 (Santiago, Chile). These events are necessary to maintaining a knowledge base for spectrum management inside radio astronomy, and

for acquainting spectrum regulators with the very particular concerns of radio astronomy.



Through a magnificent stroke of good luck, the Fifth IUCAF International School on Spectrum Management (illustrated above) took place in Stellenbosch, South Africa during the period 2-6 March 2020, shortly before the world shut down. The attendance by 55 participants was far larger than usual. This meeting could not have occurred or been so successful without the strong financial and logistical support of the South African Radio Astronomy Observatory (SARAO) and a substantial financial subvention of European participation on the part of CRAF. Owing to this generosity and in respect of the venue, the meeting was held without fees for registration and meals, including the traditional banquet, and participants were provided with a spectrum management textbook written by one of the non-IUCAF lecturers. Presentations from this and the previous IUCAF schools are available on the IUCAF website at <http://www.iucaf.org>.

5. WRC-19

IUCAF's main ongoing activity since 1960 has been participation as a Sector Member at the ITU-R in Geneva. Owing to its long history, IUCAF's work protecting radio astronomy and passive radio science are accorded a high degree of recognition.

Indeed, most of IUCAF's technical work during the period covered by this report was preparation for the two-week 2019 February ITU-R 2nd Conference Preparatory Meeting (CPM-2) of WRC-19 in Geneva, and WRC-19 that was held 28 October – 22 November 2019 in Sharm El-Sheikh (Egypt) and attended by 5 IUCAF members for periods ranging from 10 days to 4 weeks. IUCAF strove to acquire a thorough knowledge of the WRC-19 agenda by participating in the spectrum sharing and compatibility studies conducted in ITU-R Study Groups 1, 4, 5 and 7 during the period 2015-2019 and by participating in the treaty text drafting sessions in those Groups. This effort culminated in the January 2019 submission of five CPM-2 input documents describing suggested modifications of the draft WRC-19 treaty text and another document summarizing IUCAF's views of methods proposed to satisfy relevant items on the WRC-19 agenda.

[25]	Proposed modification to the draft CPM text Chapter 5 - Agenda Items 1.8 (Issue B), 1.9.1, 1.9.2	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science	2019-01-28
[24]	Proposed modifications to the draft CPM text Chapter 4 - Agenda item 1.7	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science	2019-01-28
[23]	Proposed modifications to the draft CPM text Chapter 3 - Agenda Items 1.6 and 9.1.9	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science	2019-01-28
[22]	Proposed modifications to the draft CPM text Chapter 2 - Agenda item 1.13	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science	2019-01-28
[21]	Proposed modifications to the draft CPM text Chapter 1 - Agenda items 1.11, 1.14 and 1.15	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science	2019-01-28
[20]	IUCAF views on WRC-19 agenda items of concern to Radio Astronomy	Scientific Committee on Frequency Allocations for Radio Astronomy and Space Science	2019-01-28

The consequential items in this work package were adopted into the final report of the CPM to WRC-19, especially for Agenda Item 1.14 concerning High Altitude Platform Systems (HAPS) where the unmodified CPM text would not have protected radio astronomy sites registered after May 2020. Radio astronomy bands at 153 and 322 MHz received additional protection, including in the latter case from the harmonics of emissions around 160 MHz, an unusual recognition of this kind of spurious emission.

These IUCAF positions were incorporated in the outcome of WRC-19. Modification of footnote 5.208A eventually resulted in a direct reference in the Radio Regulations to Recommendation ITU-R RA.769 containing the basic radio astronomy service protection thresholds. An effort initiated by IUCAF and presented to WRC-19 by Japan succeeded to remove a pejorative historical remark weakening protection of radio astronomy in the English language text of Article 4.6 of the Radio Regulations.

6. NEW DIRECTIONS

Until recently, improved access to spectrum for science ran through the radio frequency spectrum regulatory regime, by procuring and protecting spectrum allocations. But allocations to science have been static while the rest of the spectrum fills in with new communication systems using broad swaths of previously-allocated but unused spectrum. Adequate regulatory limits are not always placed on unwanted emissions into bands intended for science.

One of the most impactful recent developments has been the authorization of mega-constellations of satellites in low Earth orbit (LEO) by radio spectrum regulators. Radio astronomy and LEO satellite sidelobes will make the sky uniformly quite bright in the satellite downlink bands. Even beyond this, satellite trails from reflected sunlight are increasingly affecting optical/infrared astronomy, even the Hubble Space Telescope, and distorting the appearance of the night sky. Radio spectrum regulators have no brief to consider such “negative externalities.” To counter this trend, optical and radio astronomers (strongly represented by IUCAF members) and other stakeholders convened a series of Workshops (<http://research.iac.es/congreso/quietdarksky2021/pages/home.php>) on Dark and Quiet Skies and took their concerns to the Legal and Scientific and Technical Subcommittees of the Committee on Peaceful Uses of Outer Space (COPUOS) in April 2021. The output of the first Workshop, including the Radio Astronomy Working Group’s report, is available from the IAU at <https://iau.org/news/announcements/detail/ann21002/>

Closer to home, succession planning and matters of engagement continue to be of concern. Several nations with major investments in radio astronomy and/or strong histories of participation are not currently represented by astronomers in spectrum management despite IUCAF prodding.

7. ACKNOWLEDGEMENTS

IUCAF is grateful for the organizational and financial support that has been given by ICS, IAU, URSI and COSPAR, especially the URSI Secretariat that so efficiently and helpfully manages IUCAF's finances and logistics. IUCAF also recognizes the support given to individual IUCAF members by their home institutions, allowing them to participate in the vital work of the committee. IUCAF especially appreciates the contributions of the organizations and individuals who made the spectrum management school such a resounding success in March 2020, as the world was about to shut down.

Respectfully submitted,

Harvey S. Liszt, Chair
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13 June 2021