EUROPEAN SCIENCE FOUNDATION

24 CRAF News

The newsletter of the ESF Expert Committee on Radio Astronomy Frequencies

November 2011

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Editorial

Radio waves are natural phenomena that ignore national boundaries which are mere human conventions. The additive property of electromagnetic fields, determined only by their strength and irrespective of their origin, is responsible for the indiscriminate reception of radio waves within a particular receiver bandwidth. The reception of many competing signals reduces the signal to noise ratio for the wanted signals, and hence the useful channel capacity. This is nowhere more true than in the case of radio astronomy and other passive services, where the wanted signals are extremely small compared with local terrestrial emissions. It is also true for other services, and the unyielding laws of nature eventually force all spectrum users to come to a consensus. This was painfully recognised at the beginning of the 20th century and led to the establishment of the ITU and the regular world radio conferences. Thousands of delegates from all nations meet for four weeks to find a global consensus on the utilisation of the radio spectrum. The subjects for discussion and the action items are prepared in detailed national and regional consultations over the course of several years. It exemplifies the timescale of human political processes, particularly if one remembers that it takes radio waves 30 ms to travel 10 000 km. Effective human legal processes are 10^9 times slower than the radio communications with which they are dealing.

The complexities of a historical regulatory scenario and associated technical constraints, as well as the perpetual 'horse-trading' by industry and administrations to obtain favourable deals for various special interests, make the process slow and cumbersome.

However, regulatory self-consistency within the known technical constraints, as seen from the perspective of potential victim services, is the only way to achieve workable regulation. Such consistency requires that all emissions are treated equally. Radio interference is a detrimental effect, irrespective of its origin, be it national or from abroad; be it from a licensed Earth- or satellite-based transmitter; or a licence-free industrial device. Consistency also demands that all parties abide by the regulations and by-laws, irrespective of their political power or economic importance. The alternative would be the loss of spectrum efficiency, ultimately for everybody.

Let us hope that the coming WRC will continue to strive for regulatory consistency and be successful in its quest.

Axel Jessner, *CRAF Chairman*

Cover
Observatoire du Plateau de Bure operated by IRAM.
One of the six dishes by moonlight

Report from the 52nd CRAF meeting

The 52nd CRAF meeting was held on 23-24 May 2011 in Granada (Spain) at the Vincci Hotel. During the afternoon of the 24th, the IRAM - Pico Veleta Observatory was visited by interested participants. Seventeen CRAF members attended the meeting. The following key items were discussed:

• ESF situation

A new organisation to replace the European Science Foundation is to be formed by the European research funding and active research agencies. It will have its headquarters in Brussels and is to represent the voice of European science in the political arena. The new organisation will have no funding role and all previous programmes and commitments of the ESF will be wound down within the next three years. The outcome of the evaluation process for the expert boards and committees will be decisive for the future of committees like CRAF within the new organisation. The evaluation process has been re-orientated towards that goal. CRAF sees some legal and procedural hurdles for the transfer to the future organisation of the MoU between the ESF and the ten observatories covering the activity and funding of CRAF. CRAF has stressed the need for an efficient information flow between the policy makers in the new European science organisation and the expert committees (such as CRAF), in particular suggesting that the expert committees should be represented on the board making the policy decisions. Governance hierarchies should be such that within the new organisation information about important issues will reach all concerned without delay and prejudice.

• Expert Panel on RFI and EMI issues for the SKA

Axel Jessner has been proposed for (and has accepted) membership of the Expert Panel on RFI and EMI issues established by the SKA Science and Engineering Committee (SSEC) as a part of the process of site selection for the SKA. This panel will evaluate the RFI reports resulting from measurements at the two candidate sites in Australia and South Africa. See also the article by Millenaar in this issue entitled "Finding the best site for the SKA".

• RadioNet budget

The new combined RadioNet application received 14 out of 15 points in the evaluation by the EC and it is expected that a total funding of 9.5 MEURO will be granted. For RadioNet3 (2012-2016), CRAF had argued for funding for travel, LOC support for CRAF committee meetings (two per year) and support for the participation of CRAF members on international committees (ITU, ECC). However in these times of austerity, the RadioNet select committee has only found it possible to apply for ~2/3 of the comparatively small amount of what CRAF had estimated would be required. Some 'belt-tightening' and a re-organisation of meetings is inevitable.

• Statutory end of Chairmanship in December 2011

At the end of 2011, the term of office of the current Chairman will end and a 'Finding Committee' will be established to identify possible new candidates for the next period. Axel Jessner informed the plenary session that he is available to continue for a second term.

• Industrial Interference

An input document entitled "Estimate of Emission Limits for Interference to Radio Astronomy from Industrial Equipment" was presented by Axel Jessner. Industrial electronic equipment has radio emission limits specified by CISPR/EN standards. These serve to protect the devices themselves, other adjacent equipment and ordinary radio equipment. However, for radio astronomy the interference potential is much more severe and additional shielding or large separation distances are required for frequencies up to several GHz. A better harmonisation between the CISPR and ITU emission limits is required.

• IRIDIUM

Baan gave a presentation on the progress of the IRIDIUM interference issue in which CRAF has been involved for more than ten years. Measurements of the IRIDIUM interference in the radio astronomical band, 1610.6-1613.8 MHz, using radio astronomical equipment and techniques for observation and calibration, were made at the Leeheim monitoring station at the invitation of the ECC. The station is capable of tracking individual satellites and, for the first time, sensitive calibrated spectra and incontrovertible proof of the IRIDIUM out of band emission interfering in the radio astronomical bands were obtained. The data and data reduction methods were made public and IRIDIUM representatives were closely involved in all stages of the measurements and consultations. A new report stating that IRIDIUM interference leads to radio astronomical data loss of between 90 and 100% for deep (2000 second integration spectra) and 5-44% for short (30 second) observations has been approved by the ECC committees and is now in the public consultation stage. The report not only supports the interference reports made by many observatories (these cannot track and unambiguously identify the satellites, as

four are typically visible all the time), but also reproduces the theoretical interference estimates of ITU-R SM. 1633 and the pre-operational measurements carried out on fully-loaded satellites in 1998. CRAF provided evidence that the interference is caused by non-linearity in the satellite transmitting elements, the effects of which increase with the 7^{th} power of the output signal. Discussions are now commencing in the ECC and between CRAF and IRIDIUM on how to find a practical solution to the problem and to avoid its repetition with the next generation of satellites.

Pietro Bolli

Threats to millimetre astronomy?

The "Institut de Radio Astronomie Millimétrique" (IRAM, http://www.iram-institute.org), operates two telescope sites, one on the Plateau de Bure at a height of 2550 metres in the French Alps, and the other on Pico Veleta at an altitude of 2904 metres in the Sierra Nevada, close to the city of Granada in southern Spain. The Pico Veleta telescope is a 30-metre antenna dedicated to observations at frequencies above 75 GHz. Until now almost totally interference-free observations have been possible because of the high frequencies used, and also because of the very high altitude of the telescope. However, with the steady expansion of activities to higher and higher frequencies, the situation could degrade quickly in the near future. An alert came five years ago with the launch of Cloudsat, the first of a set of earth exploration satellites. Cloudsat uses a nadir-looking radar at 94 GHz, which, if there were to be direct main beam to main beam coupling between its antenna and the 30-m parabola, would result in damage to the cryogenic receivers of the radio-telescope. Although the Cloudsat orbit does not pass through the zenith of the observatory, Cloudsat has effectively forced IRAM to take the following 'preventative' actions both to protect the 30-m telescope receivers from certain destruction (in the case of loss of control of the satellite), and also the observations from contamination:

(a) a window along the path of the beam is closed whenever the antenna elevation is above 88.5 degrees,
(b) the orbital position of Cloudsat is monitored every 5 seconds, and
(c) an alarm is sounded if the angular separation of the telescope beam and the Cloudsat satellite is less than 25 degrees, effectively informing the observers of possible contamination.

Another threat comes from vehicle Short Range Radars (SRR), which work at 79 GHz. Amongst the legal protection documents issued by the Spanish authorities is one which defines a circular protection zone of 15 kilometres radius around the observatory. This is supposed to prevent harmful interference. However, the city of Granada, some 20 kilometres away and therefore outside this zone, is in a direct line of sight to the antenna and, unfortunately, estimations of the expected radiation level from these devices reaching the observatory lead to the conclusion that strong interference could occur. Moreover, nobody has, as yet, established a practical mechanism for the de-activation of car SRRs whenever one enters this protected area.

Is the era of 'peaceful' millimetre radio-astronomy coming to an end?

Gilles Butin, Juan Penalver

News on UWB

In recent years CRAF has participated actively within the CEPT-ECC project teams on the subject of Ultra Wide Band (UWB) technology. This summer, two significant pan-European public consultations on this topic took place. The first was on ECC Report 170: "*Specific UWB applications in the bands 3.4-4.8 and 6-8.5 GHz*[1]*...*" and the second on draft amendments to ECC/DEC/(06)04: "*... on harmonised conditions for devices using Ultra-Wideband (UWB) technology in bands below 10.6 GHz*". CRAF responded to both of these public consultations in detail with suggestions for changes to the texts targeted on enhancing the protection of radio astronomy. CRAF's principal concern is with proposals affecting the 6.7 GHz Radio Astronomy Service (RAS) band, as this falls within the 6 – 8.5 GHz area of the spectrum listed by CEPT for various UWB applications. We believe that there are two important issues arising from the application of these devices:

– the use of several similar devices co-located (*the composite device*)
– the likely distribution of large numbers of these composite devices in use around observatories (*aggregation of multiple interferers*).

1. Location tracking applications for emergency services (LAES), general industrial location tracking applications (LT2) and location tracking and sensor applications for automotive and transportation environments (LTA)

• The composite device

In the automotive and transportation cases, without any other mitigation in the form of lower duty cycle or activity, the free space protection distance for a station of the RAS from a single UWB device operating with the regulatory e.i.r.p. limitation of -41.3 dBm/MHz at 6.7 GHz, is 23 km (using the protection threshold for radio astronomy spectral line observations given in ITU-R Recommendation RA.769). However, duty cycle limitations of 0.5% are the likely norm [see ETSI TR 102 495-7 V1.2.1 (2010-03)], and for these this reduces the distance to 1.8 km, but this is still significant. More importantly however, it is envisaged that each vehicle is likely to be fitted with not just one, but several individual devices. At 6.7 GHz four active devices have been considered as typical in studies, but the maximum number is as yet unregulated. In that case, the vehicle becomes a cluster of UWB devices and should be treated as one composite emitter. CRAF maintains that sufficient protection for an observatory against interference from an unspecified number of co-located, randomly operating mobile UWB devices requires adoption of an exterior limitation per device e.i.r.p of -55 dBm/MHz – 10log(N_{dev}) in the band 6650.0 – 6675.2 MHz. Here, N_{dev} signifies the number of co-located active UWB devices with a long term duty cycle of 0.5%.

• Aggregation of multiple interferers

Aggregate interference from a large population of composite UWB devices distributed around an observatory can, depending on their density, create a significant additional noise background. CRAF studies of aggregate emissions, calculated using the ring integration method based on a spatially averaged emission of -70 dBm/MHz and a propagation model for rural environments from ITU-R Recommendation P.452, have shown that even for deployment densities around an observatory as low as 15 per sq.km, ITU-R Recommendation RA.769 interference thresholds may be contravened (this includes an allowance for a likely observatory managed exclusion zone of ~300 m around a telescope). However, densities of >100 per sq.km are not unrealistic for significant fractions of a 24 hour cycle even in the rural areas around European radio telescopes.

• The 6.7 GHz RAS band

This band (6.650 – 6.6752 GHz), includes the methanol (CH_3OH) line and is covered by footnotes 5.149 and 5.458A of the Radio Regulations, whereby national administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. The methanol line has become an important diagnostic for the conditions in high-mass star formation regions. The study of such regions is also important for the understanding of the formation of our solar system and the composition of elements in our sun and in the planets of the solar system. Extensive new research programmes have been started in several countries. The MPIfR (GER) and the NSF (USA) are planning an astrometric survey of such star forming regions; measuring trigonometric parallaxes for a large number of such regions in spiral arms will enable model-independent distances and transverse velocities to be determined. Significant investments in new receivers for this frequency band are also being made all over the world. A newly developed receiver system, the 'Vivaldi' focal plane array will cover frequencies in the range from 4 to 8 GHz. It will be installed at the radio telescopes in Westerbork (NL), Sardinia (IT) and Jodrell Bank (UK). Germany and the US are cooperating on a new receiver system for joint high resolution VLBA observations, and in Australia a new 7-beam receiver system, operating at the frequency of the methanol line, found several hundred new star forming regions. It is planned to install a copy of that receiver at the Effelsberg telescope in Germany.

• Summary

The 6.7 GHz band is without question of considerable future importance for radio astronomy; this importance is not fully reflected in its regulatory protection.

CRAF believes that since vehicles may be equipped with an as yet unlimited number of UWB devices emitting in an unspecified manner into arbitrary directions, the vehicle itself should be seen as a mobile composite device and regulated accordingly. Also, the likely deployment density of these composite devices around observatories is as yet unknown, and CRAF believes that once on the market, the natural proliferation of such devices cannot be constrained. It is therefore essential that the protection requirements of the RAS are met and that European regulation provides adequate and effective protection measures **in advance** against interference.

Harry Smith

The World Radio Conference of 2012 (WRC-12) is approaching!

The cycle of work within the global spectrum management community is shortly to peak. Every 3 or 4 years, the world's spectrum regulators, managers and engineers, representing hundreds of member states and interested sector groups, meet in Geneva under the auspices of the International Telecommunications Union (ITU) to discuss and agree the way that the radio spectrum is to be used and regulated in the coming years. WRC-12 is scheduled to commence on 23rd January 2012 and close on 17th February 2012; four weeks of discussion and debate. WRC-12 has a very wide scope; it deals with agenda items that range from detailed requests for new or modified frequency allocations for specific service applications, to much more ambitious agenda items considering such things as the regulatory and societal implications of newer radio technologies.

Both the conference and the substantial preparatory work in advance have the goal of reflecting the views of all stakeholders on the various conference agenda items. Stakeholders are quite diverse; CRAF represents European radio astronomers and observatories of the Radio Astronomy Service (RAS) as a sector member of the ITU. The RAS, being a passive non-commercial service, inevitably encounters other stakeholders having aggressive demands for extra spectrum, with proposals that could potentially be detrimental to the operation of radio observatories (usually by making RAS bands unusable because of increased levels of interference). CRAF's role is to participate in the discussions and contribute technical compatibility studies to draw attention to the need for effective regulation to protect RAS bands.

• WRC-12 Agenda Items ('AIs')

In advance of a WRC, CRAF publishes a document which gives its formal position on all of the main agenda items of relevance to the RAS[2]. This is promoted widely within the CEPT-ECC regulatory community. These positions are developed in advance of the conference during discussions at CRAF plenary meetings (where CRAF members meet twice a year), and by various electronic means. The following paragraphs give a brief outline of the contents of this document and some of the upcoming WRC-12 agenda items that are of far reaching significance to the RAS.

2. For WRC-12 it can be obtained by following this link to the CRAF website: http://www.craf.eu/CRAF_WRC-12PosnV4.3.pdf

AI – 1.6: "*to review No. 5.565 of the RR in order to update the spectrum use by the passive services between 275 GHz and 3000 GHz, in accordance with Resolution 950 (Rev. WRC 07);*"

This is an important agenda item for the RAS owing to our increasing use of this part of the spectrum. There are as yet no formal allocations at these frequencies and provision needs to be made for the protection of passive services until such time as the Table of Frequency Allocations is extended. The remote geographical location of the few RAS stations making observations at these frequencies does not necessarily mean interference free co-existence with new active services applications. CRAF supports the proposed revision of RR footnote 5.565 including modified lists of frequency bands used by the RAS, EESS and SRS.

AI – 1.8: "*to consider the progress of ITU R studies concerning the technical and regulatory issues relative to the fixed service in the bands between 71 GHz and 238 GHz, taking into account Resolutions 731 and 732 (WRC 2000);*"

CRAF believes that an appropriate international regulatory environment should be put in place, taking into account the requirements of all the passive services. Protection of the RAS will require coordination zones around observatories operating at these frequencies. FS links at 71-76 and 81-86 GHz that were specifically designed to take into account the protection requirements of the ALMA radio telescope were recently implemented in Chile. CRAF supports efforts to develop regulatory protection for passive frequency bands in the 71-238 GHz range and urges that appropriate mandatory in-band or adjacent-band limits are developed, together with necessary co-ordination zones to ensure adequate protection of radio astronomy and other passive services.

AI – 1.19: "*to consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU R studies, in accordance with Resolution 956 (WRC 07);*"

Although use of the RAS passive RR 5.340 bands by active radio systems using cognitive techniques will be completely excluded, Cognitive Radio Systems (CRS) are a potentially significant threat to radio astronomy and passive services generally. The principle RAS concerns on this issue relate to active CRS operating in shared bands or within a defined radio quiet zone. Protection of the RAS implies that the CRS system knows its geographical location and has some means of determining what the implications of its location are. CRAF believes that active

CRS applications are incompatible with the RAS and other passive services in shared bands without effective regulation; emissions from active CRS systems must be prohibited in the bands listed in RR Nos. 5.340 & 5.149 and in internationally recognized radio quiet zones.

AI – 1.22: "*to examine the effect of emissions from short-range devices on radio communication services, in accordance with Resolution 953 (WRC 07);*"
In Europe there is a significant threat developing to radio astronomy use of the 6 650 - 6 675.2 MHz band from mobile short range/ultra wideband devices. Operation of these devices would be allowed on a non-interference basis; however, emission limits currently proposed have the potential to generate significant interference to stations of the RAS in even medium density deployment situations. This is in contrast to the intention expressed in 5.149, in which administrations are urged to take all practicable steps to protect the RAS from harmful interference. CRAF believes that should any provision relating to SRDs be included in the Radio Regulations (at whatever frequency), compatibility with and protection of radio astronomy should be ensured via appropriate regulation.

AI – 1.25: "*to consider possible additional allocations to the mobile-satellite service (MSS), in accordance with Resolution 231 (WRC 07);*"
MSS operators state the need for additional bandwidth for both uplinks and downlinks for their systems. One candidate band for allocation is directly adjacent to the 10.6 GHz RAS band (downlink) and another is close to the 15.4 GHz RAS band (uplink). Compatibility studies have shown that there would need to be exclusion zones around observatories for handset uplinks to protect the RAS in the 15.4 GHz band and that MSS operators would need to place significant additional filtering in their systems to protect the RAS from satellite downlinks in the 10.6 GHz band. CRAF does not support these proposed allocations and is urging administrations to support the generation of adequate regulatory provision to protect the RAS.

• WRC-15
What of the future when WRC-12 is behind us? One of the 2012 conference agenda items considers topics to be covered at the next conference. This can provide an early opportunity for CRAF to make its voice heard. For example, two issues that are of interest to radio astronomy that are proposed for consideration at WRC-15 are possible allocations to active services at ~77 GHz and to Earth Exploration Satellite Services (EESS) at ~10 GHz.

Radio astronomical observations in the band 77.5 – 78.0 GHz are covered by footnote 5.149. The mm-wave regime is already strongly affected by quantum noise in the receivers and radio astronomy utilises wide bandwidths in order to achieve sufficient sensitivities. CRAF believes that new allocations for active services should not be allowed to compromise the operation of radio observatories in the band 77.5-78 GHz and in adjacent bands.

For EESS, the proposed new generation of very powerful ground imaging radars can illuminate the site of a radio observatory with pulses having a peak power flux density of 0.02 – 0.06 mW/m^2. A 100m radio dish may collect up to 0.3 W per pulse which can destroy RAS receiver front-ends. Severe interference in the form of blocking or even damage can be expected even when EESS and RA antennas are not aligned and the receiving band does not coincide with the EESS band. Unless effectively suppressed, the unwanted emissions of the EESS systems can be a far ranging source of radio interference for radio astronomy in the adjacent 10.6 - 10.7 GHz band and in the 8.4 - 8.5 GHz space research band used for geodetic VLBI measurements by radio observatories together with ground stations of the space research service. CRAF will urge administrations to ensure effective protection of radio observatories and space research stations operating in adjacent bands.

Harry Smith

Finding the best site for the SKA

The Square Kilometre Array (SKA) radio telescope project has entered a crucial stage: the time is approaching rapidly when the site for this huge future telescope will be selected from the two candidates. For Australia/New Zealand and Southern Africa these are nail-biting times. They have done their ultimate best to convince the science, technical and funding community that theirs is the best site to locate this facility that promises to deliver transformational science.

• Site information
As part of the process leading to a selection of a site for the SKA, the candidates to host the site have been requested to provide information on a large number of topics. This is an important phase in the selection process and the responses give insight into how implementation of the SKA at the candidate sites is seen and at what

cost. Naturally, information was also requested about the way the radio environment can be protected at their site. Both candidates have announced that Radio Quiet Zones (RQZ) around the locations of the core sites will be established. The RFI environment, now and in the future, within these RQZ's is very much dependent on the specifications set, and how much they can in practice be achieved and enforced. Existing laws and new legislation will play a dominant role in protecting both the SKA and also the local and regional radio spectrum management organisation and its effectiveness. For this reason the candidates have been requested to provide information on the following topics.

1. The technical properties of their RQZ, such as frequency coverage, maximum allowed levels of interference and distance scales.
2. The timeline for establishing the RQZ.
3. Legislation: the way the RQZ is based in local and national laws, how it will be enforced, and the mandates and roles of local and national authorities and the SKA organisation in maintaining and overseeing the RQZ.
4. Spectrum Management: the quality of the RFI environment generally, and of the RQZ for the SKA specifically, is influenced both in critical and in subtle ways by the spectrum management regimes in place in the host country and in any other countries where remote stations of SKA2 are situated. This also includes the range of special measures that are taken in these countries to minimize the impact of legitimate spectrum use.
5. Spectrum usage: A Radio Quiet Zone concerns a localised management of the radio interference environment. Influences from remote areas will be felt inside the RQZ. Therefore current and future spectrum usage is a very relevant aspect of the environment for the SKA.

The responses of the candidates to these questions have been received and an international Panel of experts in these matters has reviewed the responses. The Panel has written a report of their findings. The next step is that an external consultant will bring together the Panel's report on RQZs and spectrum management and the report on the evaluation of the current measured RFI environment and make an assessment of the future developments to be expected in the area of RFI conditions at the SKA locations. Another international Panel of experts is looking at the results of the measured RFI and, at the time of writing, their report is due to be delivered. More on these RFI measurements in the following paragraph.

• Radio Frequency Interference (RFI)

The high sensitivity RFI measurement campaign to characterise the interference environment at the two candidate core sites was completed in 2010.

For South Africa this took place near the seven KAT telescopes in the Karoo. At this site measures were taken to minimise the amount of interference generated by the presence of humans and installations. That meant keeping the number of people down to the absolute minimum and also shutting down electronic equipment at the site, including the KAT telescopes and PAPER.

In Australia the RFI measurement station was positioned near the very first ASKAP dish in the Outback at Boolardy. This site would be bustling with activity once a new batch of precursor antennas appears at the site, but during the RFI measurement campaign all was tranquil here, avoiding man made interference as much as possible.

At both sites the campaign was started with a set of test measurements, progressing into the agreed schedule of RFI measurements in two polarisations and four prime directions along the horizon. The measurements

Figure 1. (left)
Deployment of RFI measurement station in the Karoo.

Figure 2. (right)
The RFI station in the West Australian Outback at Boolardy.

were completed satisfactorily, resulting in a set of high sensitivity measurements at these two candidate core sites.

What remained for this project was to carry out measurements at four locations of remote stations for each of the two countries. These measurements could not be completed before almost a year was over. There were hardware and software issues at the root of this, but establishing the locations of these sample sites was also quite difficult. The selection could not be made before the array configurations for the two cases were completed, including refined positions for all remote stations. It must be remembered that these remote stations are situated outside the RQZ and that therefore locations must be chosen that offer the best compromise between array science quality and radio environment quality, while at the same time being affordable in the light of access by road, for power and fibre connections. Once these uncertainties were out of the way, the teams in the two countries travelled from one selected remote site to the next, covering large distances and returning home with a valuable set of measurements. The measurements were processed and the results reported and submitted to the Expert Panel.

• What's next?

Once the dust has settled after the Expert Panels and external consultants have done their jobs, and the site for the SKA has been selected, it will be possible to publish the results of the measurement campaign. It is expected that this point will be reached in the first months of 2012. Until then the user community will have to remain patient, because results cannot be shown as this would frustrate and jeopardise the selection process. The results will show the amount of undisturbed radio frequency space, and will help to set the specifications for RFI robustness for the receivers that will be developed. Whatever the selection outcome, it will be clear that the SKA site will enjoy the best conditions in the preferred regions of this planet.

Rob Millenaar, Chief Site Engineer,
SKA Program Development Office

Working Party 7D at the ITU – Radio Astronomy

As has already been indicated in the article by Harry Smith, the World Radio Conference of 2012 (WRC-12) will take place early in 2012. For the last 4 years there has been much discussion and hard work at meetings at the International Telecommunications Union (ITU) in Geneva, considering future spectrum use for the benefit of society as a whole. Astronomers are often asked "What use is Radio Astronomy? Why are 'we' wasting so much money on it when it could be invested in medical research to enable people to live longer, or in new technology to allow instant communication with whoever we want, no matter where they are in the world?" It is not for me,

Figure 3.
Burnt-out transformer from an electrical power distribution network caused by the March 1989 flare.

here, to discuss the benefits, or perhaps one should say the desirability of the above – such discussions could last for a very long time, especially if they are uninformed. To try to ensure that at least 'informed discussions' take place prior to decision making, although that does not mean that a sensible decision as viewed by everybody will result (as with any international organisation, 'politics and money' always play a role!), the ITU produces REPORTS on a wide variety of topics concerned with telecommunications. Working party 7D of Study Group 7 (Science Services) has been one of the main contributors, if not the contributor, to two such REPORTS during the past few years, one of which is already published, and the other is expected to be during this next year. These are entitled:

1. The essential role and global importance of radio spectrum use for Earth observations and for related applications (http://www.itu.int/pub/R-REP-RS/en and select RS.2178).
2. Characteristics of Radio Quiet Zones.

They provide a wealth of information with the first of the above REPORTS showing very clearly, as is stated in its conclusions, that "the use of spectrum by the radio astronomy service has very considerable societal weight and economic value. These services have developed technologies which have found applications in many other sciences such as medicine, telecommunications, time and frequency standards, Earth observation, computing, navigation, geodesics and mining". Several examples of the above are given in the report,

We are all aware of the devastating effects of earthquakes, hurricanes and other natural disasters, but, as stated in the 'Essential Role...' REPORT, it is perhaps "not so widely appreciated that the Sun is not a consistent or constant engine" and that monitoring of solar radio emission by a worldwide network of radio telescopes (see the article on CALLISTO in CRAF newsletter 21) is helping to provide an early warning system of damaging solar activity, and might actually prevent just as much destruction of modern-day infra-structure and perhaps significant loss of life as might be caused by the above more well-known phenomena. Giant Solar Flares, which seem to occur randomly in time (e.g. the last recorded one was in 1859), could have an extremely severe impact on our modern, technologically dependent society with its reliance on power and communication infra-structure. In March 1989, a 'very large' flare resulted in costs of ~750 Million Euros. Figure 3 shows a burnt-out transformer from an electrical power distribution network caused by the flare. Without action to close systems down to minimise damage during the time between the occurrence (as monitored by radio waves reaching the Earth) of a Giant Solar Flare, such as the one that occurred in 1859, and the actual arrival of the flare at the Earth, estimates of the costs of the effects approach 2.5 trillion Euros, with an expected period of at least 3 years to rectify.

Peter Thomasson

Committee on Radio Astronomy Frequencies (CRAF)

CRAF is an Expert Committee of the European Science Foundation. Established in 1988, it represents all the major radio astronomical observatories in Europe. Its mission is to coordinate activities to keep the frequency bands used by radio astronomers in Europe free from interference.

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November 2011 – Print run: 300