

## CRAF NEWS

Expert Committee on Radio Astronomy Frequencies (CRAF)

### Editorial

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First a warm welcome to three new official members of CRAF. It has been a long time since we have seen such an interest in finding a common position within Europe on Passive Spectrum Management issues. The interest comes from two new nations for CRAF: Greece, in the person of Dr John H. Seiradakis, and from Ukraine, in the person of Professor Alexander A. Konovalenko. The third new member is going to represent the International VLBI Service for Geodesy and Astronomy, for now, through its Chair, Wolfgang Schlüter.

CRAF considers this a big success, as it is a demonstration, by both new and old institutions involved in the passive use of the radio spectrum, of the appreciation of the work we have done so far. At the same time we realise the need for an internal activity of self-teaching and self-learning, the final objective being the active motivation of each CRAF member to recognise the value of his specific contribution to the common cause of keeping the radio astronomy bands free from interference in all EU countries. In order to achieve that final goal, we will always stress the importance of each CRAF member establishing and keeping efficient connections with their national administrations.

The old idea of inviting user scientists to our meetings received very little positive reaction in the past. On the other hand, the recent idea of presenting a seminar to the host institute at the time of a CRAF meeting, saw a rather large participation at the Max Planck Institute for Radio Astronomy (Bonn), on the occasion of the last CRAF43 plenary assembly.

Can we call this merely an exception to the rule of scant reciprocal interest between radio astronomy users and spectrum management actors? I personally do not think so; the seminar is an updating instrument very convenient for the users because it does not require them to waste their time only on a specific trip and it guarantees a presentation dedicated to a non-specialist audience. We hope that this success will be repeated in future CRAF meetings.

February 2007 saw the end of the Conference Preparatory Meeting for the World Radio Conference to be held in October: this is an added workload for most of us, where our clear views and good operational efficiency will be monitored.

Then finally, good work to everybody!

Roberto Ambrosini

### Jim Cohen: In memoriam

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CRAF has lost its best, most experienced, and – over the years – most active member. On 1 November 2006, Raymond James Cohen died, after some days of intensive care in hospital. Jim leaves a gap in CRAF which will be difficult to fill, and he will leave a gap forever in the minds and hearts of his friends and colleagues.

Shortly after CRAF was founded, in the summer of 1989, Jim became the member representing Jodrell Bank (UK), and he remained a committee member until his death. During this time he was also active in ITU, its radio astronomy Working Party 7D and several World Radio Conferences, as a longstanding IUCAF member, as chairman of IAU Commission 50 looking after the protection of astronomical sites. He was also involved in the UN Committee for the Peaceful Use of Outer Space, when COPUOS was dealing with the protection of the natural celestial environment from human-made pollution. These were only some of his activities in the radio frequency protection area.

One example of his successful work was his involvement in the GLONASS problem. It was Jim who convinced the Russian manufacturers and operators of this satellite navigation system to look into the detrimental effects of their system. He organised a worldwide measurement campaign and presented the results so clearly that the Russian side agreed with his findings. Jim was also active in the later negotiations that led to the IUCAF-GLONASS agreement. This example is not only highly visible and has consequences even today; the point is that Jim was so successful because of his unique mixture of competence and friendliness.

When the first CRAF chairman wanted to hand over the leadership to a younger colleague in 1995, Jim was so obviously the best that it was not even necessary to discuss possible alternatives. So Jim chaired CRAF from 1995 to 2000.

Jim's and my ways took slightly different directions, starting a few years ago. Having joined a space agency, I am now also looking into satellite frequencies, including their active links, which need to be coordinated and registered with the ITU. This is a bit of a complex task and the beginner has difficulties in understanding what needs to be done and in what order. At a summer school about spectrum management Jim gave a talk about satellite coordination. Fortunately I attended this

summer school, too, and remembered Jim's presentation when I had to do it myself for the first time. I was amazed how clearly Jim had understood and presented this alien issue, and indeed his paper greatly facilitated my start into this new area. How good a teacher must he have been in his fields of radio astronomy, molecular line spectroscopy, stellar evolution?!

Whatever he did, he did it very well. And he has done a lot. We will miss him.

Klaus Ruf

## Report from the 43<sup>rd</sup> CRAF meeting

16-17 November 2006

The 43<sup>rd</sup> CRAF meeting was held on 16-17 November, 2006 at the Max Planck Institute for Radio Astronomy in Bonn, Germany. The following key items were discussed.

- Two new institutions asked to become Member Institutions of CRAF. The CRAF plenary assembly unanimously approved both proposals. One is the Aristotle University of Thessaloniki (Greece), with John Seiradakis as the CRAF National Member for Greece. The other is the International VLBI Service for Geodesy and Astrometry (IVS); its Chairman, Wolfgang Schlüter, will indicate at a later time the name of IVS representative for consideration by ESF.
- The World Radiocommunication Conference (WRC-07) will be held from 22 October to 16 November 2007 in Geneva. It is recommended that CRAF representatives participate in all preparatory meetings for WRC-07. Moreover, CRAF is requested to provide a document summarising the CEPT European Common Position documents and the CRAF opinion on these matters.
- The three-year mandate as CRAF Chair of Roberto Ambrosini ended in December 2006. During the meeting, a second mandate (of two years according to the CRAF Charter) of Roberto Ambrosini as CRAF Chair was unanimously accepted by the plenary session.
- ESF offers the Forward Look instrument for supporting exploratory workshops. CRAF has organised a joint meeting on 'Active Protection of Passive Radio Services: towards a concerted strategy' in October 2004; the plenary session agreed to propose the organisation of a new meeting on this theme, dealing with the new threats and current EU environment. Since WRC-07 in October 2007 will occupy most of the CRAF members, it was agreed to postpone the workshop until 2008.

- During the meeting, the Frequency Manager highlighted that UWB technology is not compatible with radio astronomy: many bands could be affected by interference from BMA (Building Material Analysis) devices. These devices, portable radars transmitting in the spectrum range below 10 GHz, will be easily accessible to anyone, at cheap prices. Their usage in the vicinity of radio astronomy stations may produce harmful interference. The results of the studies made by CRAF for two affected bands, 2.7 GHz and 4.9 GHz, were confirmed by the administrations of UK and France. These studies have shown that for a separation distance of 500m, BMA emission limits of -68dBm/MHz eirp at 2.7 GHz and -63dBm/MHz eirp at 4.9GHz are necessary to protect radio astronomy stations. However, industry can provide emission limits of -50dBm/MHz eirp only. Work will continue on this issue. It was also emphasised that strong support from the National Telecom Administrations that have radio observatories on their territory is necessary during follow-up meetings on UWB.

- The final version (25 October 2006) of the 'Radio Spectrum Policy Group Report and Opinion on: a Coordinated EU Spectrum Approach for Scientific Use of Radio Spectrum' is now available (see <http://rspg.groups.eu.int/>).

The next CRAF meeting is scheduled for 10-11 May 2007 in Riga (Latvia) with an extra day (9 May 2007) in Ventspils to visit the Ventspils International Radio Astronomy Center.

Pietro Bolli

## Geodetic VLBI: a fundamental technology underlying the global geodetic reference frames

Over the last several decades, geodetic space techniques have improved significantly and nowadays allow observations of changes of the surface of the Earth, such as plate motion or sea level rise, with sub-centimetre precision. Global reference frames are realised in order to precisely position objects in space and on the Earth. Geodetic VLBI is one of the prime techniques; it provides baseline lengths between radio telescopes, which can be as far as 12 000 km apart, with millimetre accuracy as well as parameters that describe the rotation of the Earth. Quasars, which are observable only with VLBI, are stable markers in space realising the International Celestial Reference Frame (ICRF). The ICRF is an inertial frame that is needed, for instance, in positioning spacecrafts or probes. Geodetic observatories located on the surface of the

Earth and equipped with geodetic space techniques, such as radio telescopes for VLBI, permanently installed GNSS receivers or laser ranging systems to satellite, realise the International Terrestrial Reference Frame (ITRF). The ITRF is the basis for positioning objects on the surface of the Earth or in proximity to it. The transformation between the ITRF and the ICRF requires knowledge about the rotational behaviour of the Earth.

It is generally recognised that global reference frames are the backbone of precise and reliable positioning as required by research and applications related to global change and, in particular, to hazard research. The International Association of Geodesy (IAG) has recently established the Global Geodetic Observing System (GGOS) aiming at the realisation of the reference frames with a relative accuracy of 10<sup>-9</sup> for geometrical and physical parameters and consistent over decades. The maintenance of the global reference frames is a very complex and worldwide task, which can be solved only on an international level. In the last decade or so, international services have been established for the individual techniques under the auspices of the International Association of Geodesy (IAG) and/or the International Astronomical Union (IAU). The services which support geometric techniques are:

- the International GNSS Service (IGS),
- the International Laser Ranging Service (ILRS),
- the International VLBI Service for Geodesy and Astrometry (IVS), and
- the International DORIS Service (IDS).

The generation and provision of combined products is the responsibility of:

- the International Earth Rotation and Reference Frame Service (IERS).

Services that deal with the gravity field of the Earth, or 'gravimetric services' are, for example:

- the International Gravimetric Bureau (BGI),
- the International Center for Earth Tides (ICET),
- the Permanent Service for Mean Sea Level (PSMSL), and
- the International Gravity Field Service (IGFS).

Among the geodetic space techniques, VLBI plays a fundamental role in the process of the realisation and maintenance of the global reference frames and in the determination of the Earth Orientation Parameters (EOP). Only VLBI:

- allows the observation of quasars realising the ICRF,
- provides the complete set of EOP and is unique for the determination of UT1-UTC, and
- provides most precisely the length of intercontinental baselines, which strongly support the realisation and maintenance of the ITRF.

The year 1999 saw the establishment of the International VLBI Service for Geodesy and Astrometry (IVS). Its main functions are to coordinate the observations, the data transmission, the data analysis, the development of the technology, and the provision of jointly derived VLBI products. IVS has to guarantee that products are delivered on a timely basis and with high quality. Because of its unique role, IVS has taken over an important task and a high responsibility for society. Figure 1 shows the global distribution of the components contributing to IVS.



Figure 1: Global distribution of the components of the International VLBI Service for Geodesy and Astrometry

The observing programme consists of regular 24-hour observing sessions; e.g., two dedicated sessions per week for monitoring the Earth's orientation, and at least one session every two weeks to support the ITRF or the ICRF. A daily one-hour-long session is observed on a two-station baseline to determine the universal time difference UT1-UTC. The 24-hour sessions typically involve six to eight stations of the full IVS network, but there are also sessions with 12, 16 or even 20 stations. About every three years, a continuous campaign (CONT) with up to 12 radio telescopes is carried out over a period of approximately two weeks; this is mainly in support of research and development activities.

Frequencies used today are allocated on S-band with six channels in the domain of 2.15-2.35 GHz with 2-16 MHz bandwidth and on X-band with eight channels in the domain of 8.1-9.0 GHz with 2-16 MHz bandwidth. At some locations we are increasingly faced with radio interference on S-band. Plans for a next generation of VLBI system are under way (VLBI 2010). The new system is anticipated to have antennas and receivers with broadband capacity from 2-18 GHz. This frequency domain includes the currently used S-band and X-band and will allow future observations on undisturbed frequency bands between 2 GHz and 18 GHz.

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## RFI protection in Greece

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Greek radio astronomers feel the need to be involved in CRAF activities. This need arises from the recent revival of a proposal by the Aristotle University of Thessaloniki staff to build a new high frequency radio telescope in Greece. The initiative is strongly supported by the Director of the National Observatory of Athens, Professor Chr. Zerefos, who is actively seeking funds through the Greek Ministry of Development.

Furthermore, a low frequency radio-heliograph, Artemis-IV, operating between 20-650 MHz, suffers from increasingly strong interference and is likely to suffer more from proposals by the automobile industry to fit all cars with short range devices, which will affect all frequencies below about 10 GHz. The heliograph has been operating from the Thermopylae Satellite Communication Station since 1996, near Athens, at the scene of the 390 BC battle between the Persians and the Greeks.

**John H. Seiradakis**

The views expressed in this newsletter are those of the authors and do not necessarily represent those of the European Science Foundation.

### 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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