

## **Minutes of OTC telecon, August 30 2005, 17:00 UTC.**

Last revised 2005-09-05

**Present:** Barry Clark, Darrel Emerson, Rick Fisher, Brian Glendenning, Tony Kerr, Peter Napier, John Payne, Marian Pospieszalski, Dick Sramek, Dick Thompson, John Webber.

John Delgado was invited to the meeting to address the first agenda item.

### **Agenda:**

1. Status of OTC Recommendation about R&D contracts. (John Delgado)
2. Status report of SPS (Space Power Systems) (Dick Thompson)
3. Status of cm-wave and mm-wave satellite cloud radars  
(Peter Napier & Darrel Emerson)
4. Any other business

### **Presentations and Discussion**

#### **1. OTC Recommendation on R&D contracts.**

John Delgado reported that he, George Clark and Darrel Emerson had met to discuss how to incorporate the OTC review of R&D contracts into the procurement process. NRAO's Contracts & Procurements division does not need to become involved until after the OTC has made its recommendation on any given contract to the Director's Office. It will primarily be the responsibility of ADs and Project Managers to ensure that potential R&D contracts do receive attention from the OTC. George Clark will be presenting this at the next AD meeting, near the end of September. It was noted that two OTC members currently participate in AD meetings anyway, as part of their other NRAO responsibilities, so will be able to represent the OTC view there.

Brian commented on the advisability of there being a central point where it is checked that the OTC has been consulted, rather than leaving the responsibility to many separate individuals; it was agreed that one of the responsibilities of the Business Office should be to check that the OTC has been consulted, where necessary, before proceeding with the contract.

#### **2. Solar Power Systems**

Dick Thompson reported that there is an URSI inter-commission working group, which is preparing a white paper on Solar Power Systems. This idea was originally suggested in

1968; in 1978 Dick became involved and wrote a response, from the point of view of Radio Astronomy, to the then proposed NASA Reference System. This comprised 60 geostationary satellites, about 1 per degree, above the US. Each satellite generated 6.7 GW, leading to a delivery of 300 GW from receptors on the ground. This required an array of 5 by 10 km of solar cells on each satellite, with the transmitter antenna about one square km. The transmitters could be klystrons or some other technology – if klystrons, this might involve  $6.10^6$  individual klystrons. The receiving antennas are called “Rectennas” and consist of arrays of dipoles and detectors each covering 10 by 13 km. At the time of the report in ~1980, the review committee suggested waiting a decade to see how technology progressed. Two decades have now passed, so it’s not surprising that it’s now being considered again. Two frequencies are being considered, both within the ISM bands: around 2.4 GHz and 5.8 GHz.

The technical issues on interaction with Radio Astronomy include:

- Harmonics of the fundamental signal
- Transmitter broadband noise
- Thermal noise: the area of the solar arrays, assumed to have a physical temperature of about 360 K, implies that detrimental interference would be received from the passive thermal emission from the arrays whenever a single dish telescope is pointed within +/-15 degrees of the geostationary arc. This is a significant area of sky that becomes unavailable.
- With 6 million klystrons, assuming a 50-year mean lifetime, 10 will be failing per hour. What is the failure mode? This could involve off-frequency oscillations, broad band noise or whatever.
- Reflection of terrestrial transmitters bouncing off the large area of solar arrays could generate a significant level of interference.
- Near the rectennas, there could be severe interference from harmonics, noise and intermodulation products.

Today, Japan (JAXA) is considering building a demonstration system, producing 1 GW of power on the ground; it is likely to use 5.8 GHz rather than the 2.4 GHz of the original NASA survey. Government development money may be available.

Barry commented on the potential impact to optical astronomy; this had been included in the original NASA report.

The main point is that the idea doesn’t die. We need to watch progress and respond when necessary. Mike Davis is leading a Commission J group that is preparing input to the current URSI white paper. The ITU WP7D, which deals with radio astronomy, is also responding. There will be sessions on SPS at the URSI General Assembly in Delhi later this year.

### 3. Satellite Cloud Radars

Peter reported on the new GPM (Global Precipitation Measurement: see e.g. [http://www.eorc.jaxa.jp/GPM/contents/summary/index\\_e.htm](http://www.eorc.jaxa.jp/GPM/contents/summary/index_e.htm) ) cloud radar. This will be in a low orbit, operating at 13.4 and 35.5 GHz. Unlike Cloudsat, the radar is not nadir-pointing, but has a scanning antenna, which therefore makes avoidance of main beam - main beam coupling much more complicated. As with Cloudsat, there is a link on the IUCAF page (<http://www.iucaf.org>) where more details can be found. GPM is a collaboration between NASA and JAXA. A prototype has already been made, and has been flown in an aircraft. About 80 mW of power could be received by a VLBA antenna. There is also a European version, EGPM, under construction.

This level of power is probably not sufficient to cause permanent damage to the HEMT receivers at Ka band. Damage is sufficiently unlikely that it is not justified to put any stop band filter on the receiver. However, we do need to study this further, and produce some report similar to the ANATAC Cloudsat report.

Darrel reported that Cloudsat still hadn't been launched, but that launch is currently set for late September 2005. The latest details will be available via the IUCAF page at <http://www.iucaf.org> . Darrel also commented that the coordination relationship with JPL, although cordial, has not always been tremendously effective.

On the theme of mm-wave interference, Darrel reported that the Herzberg Institute had been receiving interference on 104.11 GHz, from what is now thought to be the 3<sup>rd</sup> harmonic of the LO signal used in the downlink of the EHF SATCOM system used during a joint US Navy/Canadian Navy exercise at the end of May 2005. They are working with the Canadian Navy to resolve this.

### 4. Any Other Business

John Webber commented that, in the long-term (2005-2007) NRAO budget proposal, the list of high priority items is taken directly from the OTC's recommendations.

Dick commented that it was very useful for the OTC to keep abreast of potential threats to radio astronomy, such as SPS and cloud radars. The OTC has good contacts with engineering staff at NRAO, and so is able to disseminate the information. Design engineers should be aware of these issues.

Darrel put in a plea for suggestions of future issues with which the OTC should concern itself. Between OTC telecons, we should continue to keep in contact via email.

*Minutes by DTE.*