

## **MINUTES**

### **of the RadioAstron Teleconference on October 18, 2006**

N. Kardashev chaired the teleconference.

The agenda of the teleconference and the list of participants are attached to the Minutes.

The main intent of the teleconference was to review current status of mission development.

1. **Andreyanov informed the participants about recent developments and plans.**
  - 1.1. Vibration tests of the science payload and the service bus "Navigator" will start at Lavochkin Association on October 24 with mass-dimension devices and systems. The tests will be done in separate configuration of the science payload and the service bus. Model in 2 stages: SC itself + onboard VIRK (starting on Monday, October 24) and Payload – SRT (starting just after previous tests). All – in transport position.
  - 1.2. Modified Formatter (EM) was tested (digital video filters, changes in frame header, only 1-bit quantization). FM will be ready in December-January.
  - 1.3. FM of 22 GHz multi-frequency RCV has been manufactured and is now under test.
  - 1.4. FM of Frequency synthesizers, Control devices, IF Selector, power supply units and RUSO are ready for integration in electronics complex.
  - 1.5. H-masers are in manufacture; EM will be ready in the 1-th quarter next year, FM – in the middle of 2007.
  - 1.6. FM of VIRK system will be ready in the beginning of the next year. Frequency nominal: 15 GHz exactly (data TRM), 8.4 GHz exactly (phase transfer down link) and 7.2075 GHz (uplink).
  - 1.7. Zero-Baseline-Tests (ZBT) with FMs are planned to the end of 2006. Now we are improving ZBT Program for flight SRT electronics.
2. **N. Kardashev, answering on questions from R. Preston, confirmed that RadioAstron project keeps the first priority among scientific space mission of the SPECTR series.** He enounced general time line of the mission development: All scientific payloads in flight electronic performance will be under tests in the ASC laboratories and SRT reflector in Lavochkin Association during April-June 2007. Then the equipment will be transferred to Lavochkin Associations for assembling with the SRT reflector and spacecraft devices and then the complex tests will be conducted till the end of 2007. At the end of 2007 space mission ELECTRO-L, which uses the same bus module, will be launched, and we may treat it as a test of RadioAstron space craft.
3. **Some discussion arose about the personal letter from president Putin to president Bush.** The letter has been sent in the middle of August. It contains request and motivation for continuing NASA support for RadioAstron mission with the USA tracking stations.
4. **A. Smirnov described achievements and plans in the development of Pushchino tracking stations:**
  - 4.1. Feed system for 22-m radio telescope will be delivered in the end of 2006 for the subsequent tests at radio telescope.
  - 4.2. All electronic equipment is under development, and the delivery is planned for the first quarter of 2007 with subsequent tests in laboratory and at radio telescope.
  - 4.3. According to general plan Pushchino tracking Station will be ready for complex tests in the end of 2007 year.
  - 4.4. In his answer for questions from Langston Smirnov explained that demodulator will operate at IF of about 140 MHz working in digital format, and feeds and LNA will operate at room temperature.
5. **G. Langston reported on the understanding and problems concerning Green Bank Tracking Stations:**
  - 5.1. Present approach is to utilize for RadioAstron and VSOP-2 tracking station 20-m antenna with prime focus optics; new feed design, developed by S. Weinreb, probably will be used.

5.2. Main design documents are being rewritten.

5.3. If funding problem will be solved soon the Tracking Stations could be ready in 2008 year.

**6. N. Kardashev and S. Likhachev informed the participants about negotiations with South Africa and Canadian space agencies** in order to search possibility to construct tracking stations in South Africa and in Canada. The meeting between Russian and South African space agencies took place two months ago, and corresponding item was included in the signed agreement. The meeting in Toronto will be held in November. Both tracking stations are supposed to be constructed for the native funding (Canadian, South African).

**7. S. Likhachev talked in brief on the development of correlator and recording system in ASC:**

7.1. Three RDR-1 (RadioAstron Data Recorder) were manufactured and tested, and now three more sets are under production for the Institute of Applied Astronomy.

7.2. The copy machine RDR-1 to Mk5 format was constructed and is under test. It will be useful to make playback test of copied data at NRAO correlator.

7.3. There are two types of correlator system under development at the ASC: software correlator to operate at some sort of cluster of computers, and hardware correlator. Both will be 5-stations with disk data recorders.

**8.1 N. Kardashev explained the situation with the preparation of the exploratory proposal** to conduct VLBI observations in K band (18-26 GHz) using existing frequency performance at the DSN 70-m radio telescopes (Goldstone, Robredo, and Tidbinbilla), and at the NRAO 100-m GBT radio telescope in order to test MFS mode of operations. All these telescopes are already equipped with the receivers completely compatible with RadioAstron providing the possibility of frequency switching in the range 18.392-25.112 GHz with steps of 960 MHz. The 22.232 GHz channel is recommended as a reference one because it's common for high frequency and low frequency sub bands at the GBT. It was proposed also to search possibility of the bandwidth increasing of Effelsberg, Mauna Kea VLBA and some others radio telescopes to be compatible with RadioAstron. A long discussion followed with R. Preston, Yu. Kovalev and G. Langston taking active part. The conclusion was to continue work on the proposal.

**8.2. As about other technical experiments: to conduct VLBI observations using several selected VLBA antennas** with Mauna Kea as very distant radio telescope, and Pie Town and Los Alamos as compact portion of the array, it was recommended, after some discussion, to reconsider more carefully results already obtained by L.Kogan and S.Likhachev. The results were presented at the at the lunch talk July 2006 at NRAO as "Multi-frequency Simulation of Space VLBI using VLA and VLBA".( One can pick up the file at ppt format from the site: [www.aoc.nrao.edu/~lkogan](http://www.aoc.nrao.edu/~lkogan). The file name is "From Russia With Love-1.ppt")

9. **The date of the next teleconference** was appointed for the first week of February 2007.

10. **The report on the fulfillment of action items**, formulated at the previous teleconference, in fact, was presented above under items (8) and (9)

11. **New action items are:**

11.2. To prepare presentation on the status and progress of RadioAstron project at the American Astronomical Society Meeting in Seattle Washington during January 2007.

*(N. Kardashev, G. Langston)*

11.3. To agree on the procedure of testing RDR-MK5 copy machine at VLBA correlator

*(J. Romney, S. Likhachev)*

11.4. To contact relevant people at JPL concerning MFS proposal for GBT/DSN.

*(Yu. Yu. Kovalev, N. Kardashev)*

11.5. To investigate possibility to send to the participants the content of personal letter from president Putin to president Bush.

*(S. Likhachev)*

11.6. To investigate possibility to modify Ku/K receiver system at the Mauna Kea VLBA antenna to be compatible with RadioAstron MFS system in 2008.

(K. Kellermann)

11.7. To investigate possibility to modify Ku/K receiver system at the 100-m Effelsberg radio telescope to be compatible with RadioAstron MFS system in 2008.

(A. Zensus)

**12. N. Kardashev informed the participants on the status of Millimetron project.**

12.2. Millimetron project is approved and included in Russian Federal Space Program.

12.3. According to this Program phase A (concept development) must be completed in 2007. The end of phase B (design, fabrication and testing) is planned to 2015 with the launch in 2016 year.

12.4. The main specifications and proposals on Russian and international cooperation for the project will be determined in 2007. Foreign astronomical and space institutions are invited for participation in project development.

Millimetron will use 12-m cryogenic dish with receivers and bolometers covering range from 2 cm to 10 microns, and will operated in two modes: as single dish space IR observatory and as SVLBI together with ALMA and others on the ground telescopes.

**Agenda of the RadioAstron teleconference  
October 18, 2006 (15:00 UT)**

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|----|--|--|
| 1  | Corrections to the Agenda  | N.Kardashev  |
| 2  | RadioAstron project status and progress  | V. Andreyanov  |
| 3  | Pushchino tracking station   | A. Smirnov   |
| 4  | Green Bank tracking station  | G. Langston  |
| 5  | Recorders and correlator in ASC  | S. Likhachev   |
| 6  | GRT tests in MFS mode<br>DSN/GBT proposal<br>VLBA proposal                     | N. Kardashev, , Yu.Yu. Kovalev<br>L. Kogan, S. Likhachev |
| 7  | Review of Action Items   | M. Popov   |
| 8  | New Action items   | M. Popov   |
| 9  | Proposed date for the next teleconference<br>(the first week of February 2007) |  |
| 10 | Information on Millimetron project development                                 | N. Kardashev   |

**List of participants:**

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|-----------------|-------------------------|
| Andreyanov V.   | ASC, Russia             |
| Baan W.         | Astron, the Netherlands |
| Kanevsky B.,    | ASC, Russia             |
| Kardashev N.S., | ASC, Russia             |
| Kellermann K.,  | NRAO, USA               |
| Kogan L.        | NRAO, USA               |
| Kovalev Yu,Yu.  | MPIfR/ASC               |
| Lobanov A.,     | MPIfR, Germany          |
| Langston G.,    | NRAO, USA               |
| Likhachev S.,   | ASC, Russia             |

|             |             |
|-------------|-------------|
| Minter A.   | NRAO, USA   |
| Popov M.V., | ASC, Russia |
| Preston R.  | JPL, USA    |
| Romney J.,  | NRAO, USA   |
| Smirnov A.  | ASC, Russia |

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