

## **MINUTES of the RadioAstron Teleconference on October 16, 2007**

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 a current status of the mission development.

### **1 V. Andreyanov informed the participants about the status and progress in technical developments achieved since the last teleconference of May 2007:**

- Mechanical tests of the SRT mass-dimension model were finished. We used 3 natural reflector petals and 24 mass simulators. Now the results are being processed. The spacecraft service module "Navigator" has been tested on vibration earlier.
- Interaction tests of the SRT electronics (EM) and SC TM system were implemented in the ASC by the specialists from the ASC, Lavochkin, and from manufacturing firms. Such tests were done first time. Technical SRT and SC TM parameters will be transmitted through SC TM system towards control station, and - through VIRK system towards tracking stations (inside data header).
- Integration tests of the SRT electronics (EM) and spacecraft digital command interface were implemented in the ASC by the specialists from the ASC, Lavochkin and from manufactures. Such commands control 22 GHz MFS Receiver, Formatter and H-maser. It was done first time also.
- Flight models fabrication of the electronics continues. The new Formatters have been tested in the ASC. New 6-cm RCV has been manufactured in Fryazino, and it will be tested by the ASC in the next month. Flight models of VIRK system and H-maser are on critical line and will be ready for the autonomous tests in the end of this year.
- New construction of SRT antenna feed (EM) has been tested in combination with the 22 -m reflector in Puschino; this reflector has the same F/D ratio as the SRT. We compared parameters of the space feeds and ground telescope feeds. The results are positive. Flight Model of the Radioastron feeds was delivered to the ASC last month.
- In Lavochkin they have started assembling of the reflector's petals (carbon-fiber covers and support construction) for flight antenna.
- Program for acceptance tests of the flight SRT was designed and now corrected. Program contains 4 stages: the electronics' tests in the ASC (including ZBT), the reflector tests in Lavochkin, open containers tests and the tests of completely assembled SRT in Lavochkin (reflector construction + electronics in closed containers + hydrogen masers).
- RSA announced new date of the RA launch – October 2008, but after the launch of meteorological SC "Electro".

#### **Questions:**

*G.Langston:* Was there RF or cable connections between the SRT and the telemetry station?

*Andreyanov:* the connections was done by cables, and the tests of link stability by RF signal is planned for the beginning of the next year.

*B.Preston:* What is the status of the RadioAstron mission at the political level in Russia?

*N. Kardashev:* RadioAstron keeps the first priority among the scientific space programs in Russia. The launch date is about three months after the Launch of the "Electro".

**2 B. Kanevsky described achievements and plans in the development of the Pushchino tracking station:**

- The upgrade of RT-22 radio telescope mechanical drive was accomplished.
- The three-frequency feed has been installed at the RT-22.
- The installation of electronic complex of TS at Pushchino site is being carried out.
- The preparation of RT-22 for operations as TS for RadioAstron project continues.
- The work of establishing clock and frequency service for TS in Pushchino was finished.

The development of the software to operate TS in Pushchino is being continued. In his answer on Glen's question Kanevsky explained that it will be impossible to transmit commands from Pushchino TS. Glen also asked to provide diagram of Pushchino TS design, especially concerning three-frequency feeds. Kardashev informed the participants that control (commanding) stations will be located in Bear Lake (near Moscow) and in Ussuriisk.

**3 G. Langston reported the status of the Green Bank Tracking Station:**

He confirms the approach to utilize for RadioAstron and VSOP-2 the tracking station 20-m antenna, but he explain that no progress was achieved recently because of lack of funding. Nevertheless, Langston made a suggestion to look for funding from NASA via scientific proposals from US universities.

**4 S. Likhachev informed the participants about** possibilities to create TS outside Russia. He said that the administration in RSA continues efforts to convince NASA to provide funding for TS in Tidbinbilla and in Green Bank. They are waiting for the response on the letter sent from president Putin to president Bush. As for the shipment of the equipment from Russia for tracking stations in southern hemisphere it would cost about 2 millions of USD for the ASC. Manufacturing of the equipment would take about three or four months.

**5 S. Likhachev informed the participants that ASC has manufactured 8 sets of disk-oriented recording terminals (RDR)** to be used at the Russian ground radio telescopes network and at the tracking stations. Near-real-time software correlator is under tests at the ASC. The correlator is able to process data for 5 stations. The correlator is based on the IBM multiprocessing system. S. Likhachev again asked for assistance in getting some sample of data recorded for VSOP experiments, to be used in the check-out tests of the correlator.

**6 K.Kellermann advised to the ASC specialists,** preparing in-orbit-checkout plan for the RadioAstron, to use the experience of people involved in VSOP in-orbit-checkout. G.Langston and J.Romney remind that nearly four months elapsed between the launch date and first image construction in VSOP in 1997. Therefore, a reasonable estimate of in-orbit-checkout period for the RadioAstron mission is about 6 months. The participants emphasized on the importance of the peculiarities of Radioastron orbit in the commissioning period.

**7 V.Slysh explained the situation with the development of science program for RadioAstron mission.** He described shortly the process of scheduling and informed about simulation of science program for the first four months of mission operations. Then he explained the approach to form science program of the RadioAstron mission and presented the content of Key Science Program. The summary of his presentation is attached to the minutes.

R. Preston asked about plan of development of the final KSP. J. Romney expressed his doubts about prospects of astrometry with RadioAstron.

**8. N.Kardashev made a proposal to held workshop in Moscow under the tentative title "Radio Universe with microarcsecond resolution"** in April 2008. The workshop topics will include technical aspects of RadioAstron project development as well. Inspection of the flight SRT in Lavochnik and TS in Pushchino could be organized for the participants of the workshop. It looks like the majority of the active participants would prefer May against April.

**9. Report on the execution of the action items** formulated at the previous teleconference:

- E. Fomalont -- to investigate possibilities to obtain a sample of S2 tapes corresponding to some VSOP experiments. The tapes are needed to test ASC correlator. Ed did provide the information.
- D. Jauncey -- to prepare a draft of the letter from astronomical community to Russian officials concerning of placing on board of the RadioAstron spacecraft a capsule with the ash of the first radio astronomer Groete Reber. It was not done, and after some discussions and clarifications from Kardashev the AI was transferred to K.Kellermann.
- The ASC -- to provide a presentation of the RadioAstron project at the Meeting in Manchester in October 2007. It was not done, and the ASC apologized about this.
- The ASC -- to choose a proper date for the next general RadioAstron meeting in Moscow. The AI is in progress.
- Action item to form a Science Advisory Committee has not solved yet and caused a new discussion. So, the AI still stays open.

**10. New action ites:**

- The ASC -- to display at the WEB-site principal diagram of the design of the TS in Pushchino.
- J. Romney – to look for data from some VSOP experiment at the VLBA correlator.
- M.Popov -- to request by E-mail the participants about the most convenient date fo the worksop.
- S.Slysh – to distribute abstract of Key Science Program presented at the teleconference.

**11. The next teleconference is planned to be held in January 2008.**

**Summary**

Of the presentation made by Slava Slysh at the Radioastron teleconference October 16, 2007

**Radiostron Scientific Program**

The scientific program consists of two parts:

1. Key Science Program (KSP)
2. Program composed of peer review proposal for the open access to Radioastron observations.

The allocated time will be divided between the two parts of the program roughly 50 to 50 per cent.

There is a working group (WG\_KSP) on the Key Science Program at ASC dealing with KSP projects and scheduling of observations.

WG\_KSP is selecting scientific directions, types of observations available, and compiles lists of sources. The scheduling software has been developed, which must result in the delivery of the SRS (Space Radiotelescope Schedule) file to Lavochkin Association to be used for the spacecraft control. The software was successfully tested using dummy scientific projects by ASC scientists, for a 4-month period.

The scientific directions were selected based on surveys of published literature, as well as on pre-launch observations. The pre-launch observations were carried out on ground based telescopes and VLBI arrays such as VLBA and EVN. Following projects were solicited for the KSP by the WG\_KSP:

1. M87-submas structure and its variations, including polarization.
2. Microquasars: Galactic black holes like Cyg X-3
3. BLac objects
4. Search for extremely high brightness temperature extragalactic sources. The pre-selection of the sources is being done with surveys of flat spectrum sources and VLBA survey of compact radio sources.
5. Fine structure of gravitationally lensed objects.
6. Radio astrometry: measurements of secular aberration and proper motion.
7. Pulsars: giant pulses as time calibrators; parallax and proper motion of pulsars.
8. Fine structure of H2O masers.

9. OH masers with low (or without) interstellar scattering: W48 and G34.26+0.15 unresolved with VSOP.
10. H<sub>2</sub>O megamasers with redshifts corresponding to frequencies available in the MSF receiver.
11. Gravitational redshift in the Earth's gravitational field measured with the on-board H-maser (stability 10E-15).

Although the KSP is being prepared by the ASC working group contributions from outside ASC will be greatly welcomed.

### **Agenda of the RadioAstron teleconference October 16, 2007 (14:00 UT)**

1	Corrections to the Agenda and introductory notes on the status of the RadioAstron mission	N. Kardashev
2	RadioAstron project status and progress	V. Andreyanov
3	Pushchino tracking station (TS)	B. Kanevsky
4	Green Bank tracking station	G. Langston
5	Status of TS outside Russia	S. Likhachev
6	Data recording and correlator in Russia	S. Likhachev
7	Planning of in-orbit-checkout	K. Kellermann
8	Development of science program	V. Slysh
9	Workshop in Moscow in April 2008	N. Kardashev
10	Review of Action Items	M. Popov
13	New Action items	M. Popov
14	Proposed date for the next teleconference (January, 2008)	

#### **List of participants:**

Andreyanov V.	ASC, Russia
Baan W.	Astron, the Netherlands
Kanevsky B.	ASC, Russia
Kardashev N.	ASC, Russia
Kellermann K.	NRAO, USA
Kogan L.	NRAO, USA
Lobanov A.	MPIfR, Germany
Langston G.	NRAO, USA
Likhachev S.	ASC, Russia
Lister M.	Purdue University, USA
Popov M.	ASC, Russia
Preston R.	JPL, USA
Romney J.	NRAO, USA (was not able to connect)
Tsarevsky G.	ASC, Russia