RadioAstron International Science Advisory Council (RISC)
Business meeting, October 24, 2008
Moscow, Russia

M I N U T E S

The RISC meeting was held at the Astro Space Center in Moscow, after the 4-day International Symposium “Radio Universe at Ultimate Angular Resolution”.

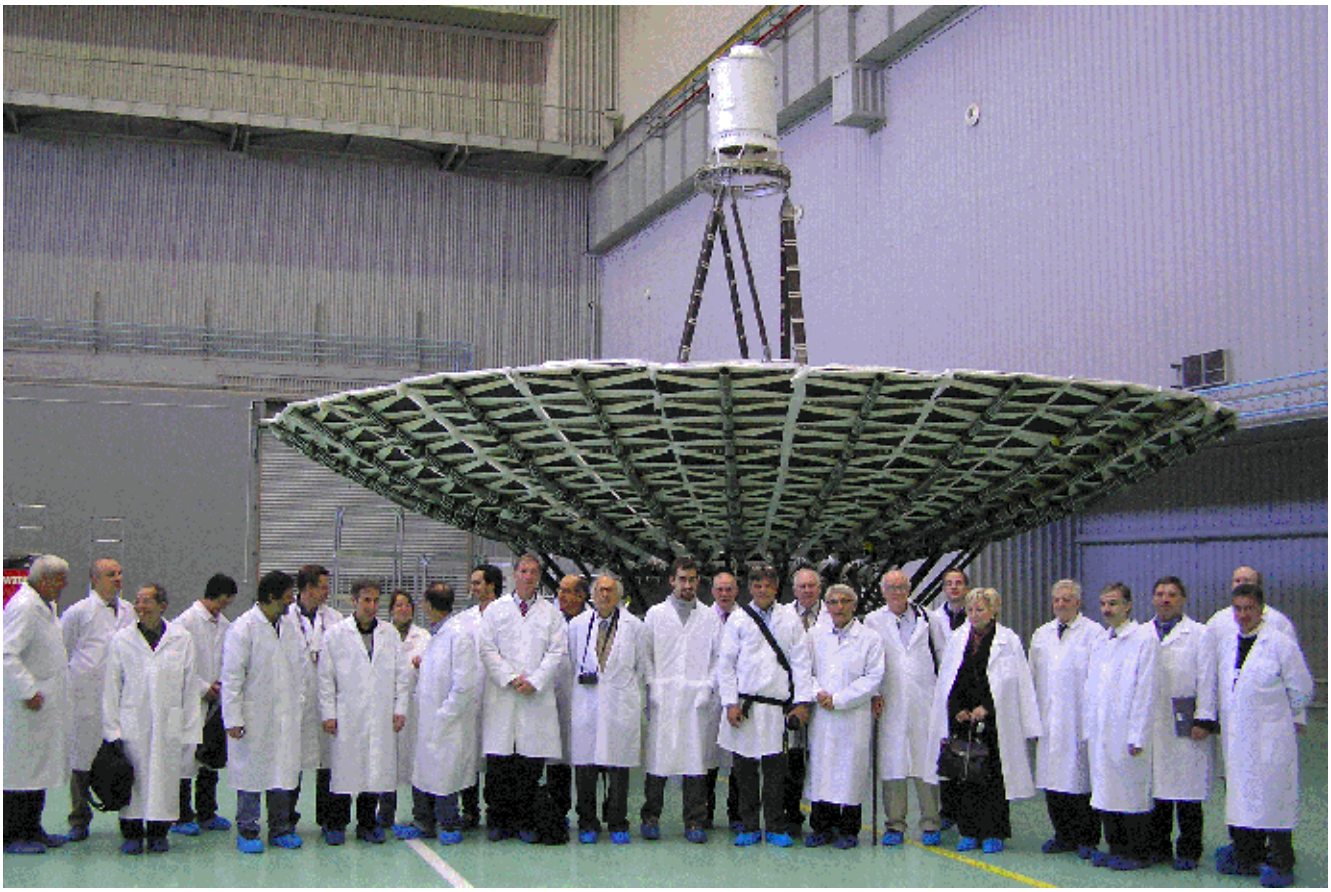
The agenda of the Symposium appears in these Minutes as Appendix C, and the list of participants is attached as Appendix D.

The broad range of scientific objectives connected with high angular resolution was presented during two-day plenary sessions, and the technical aspects of RadioAstron mission were carefully discussed in two following days of the Symposium. In the course of a visit to Lavochkin Association (LA) flight models of the SRT and the spacecraft bus Navigator were demonstrated as undergoing electrical and mechanical tests in the workshop. The LA General Director, G. Polyshuk assured the participants that status of the SRT development in LA as well as the provision of necessary funding, provide the possibility that the scientific payload and spacecraft bus will be ready for launch in the end of 2009. Flight models of scientific payload were shown at the ASC; they are checked and being prepared for zero-baseline interferometric test (Z).

Participants in the meeting:

Andreyanov V.	ASC	Russia
Baan W.	ASTRON	Netherlands
Bartel N.	York University	Canada
Burke B.	MIT	USA
Frey S.	FOMI, SGL	Hungary
Garrett M.	ASTRON	Netherlands
Giovannini G.	IRA	Italy
Gwinn C.	USB	USA
Hirabayashi H.	JAXA	Japan
Jauncey D.	CSIRO	Australia
Ipatov A.	IAA	Russia
Kardashev N.	ASC, co-chair	Russia
Kellerman K.	NRAO, co-chair	USA
Kovalev Y.Y.	MPIfR	Germany
Langston G.	NRAO	USA
Likhachev S.	ASC	Russia
Lobanov A.	MPIfR	Germany
Popov M.	ASC, secretary	Russia
Shen Zhiqiang	SHAO	China

Some participants were representatives of organizations, some were invited by the chairs, some were observers.



The following agenda items were discussed during RISC business session.

1. **RISC membership, cochairman, secretary**

The criteria for RISC membership are described in the ToR and were approved by RISC. It was recommended that the project leadership continue their efforts to invite new members.

2. **RISC Terms of Reference (ToR)**

The draft version of the new ToR was discussed and adopted with modifications. The primary change from the previous ToR is that the name of the RISC now includes the word 'advisory' in order to clearly define the role of the RISC for the RadioAstron project. The new version of the ToR is attached to these Minutes as Appendix B.

3. **Science Programs: Major Large Programs and PI Driven Programs**

M. Popov, acting as a representative of RadioAstron Project Leadership (RPL), informed the participants on the understanding, by the RPL, of scientific access to the mission.

The mission will begin with a "commissioning phase" or In-Orbit-Checkout (IOC) period. The first part of the IOC will include "engineering commissioning" with a spacecraft bus checkout,

SRT unfolding, tests of the radio astronomy antenna in a single-dish mode (boresighting), and tests of communication with tracking stations (VIRK system). It is expected that this engineering commissioning period will take about three months. The second part of the IOC will be a "scientific commissioning phase" consisting of tests of the SRT science payload in VLBI mode with large ground radio telescopes and will require access to the large international ground radio telescopes as well as those located in Russia.

This second phase of the IOC, although designed only for engineering checkout, may produce the first scientific results of the mission, and will be smoothly transitioned into a "scientific verification phase" of the *Early Science Program* (ESP) with the duration of about 3-4 months. There would be no AO for the ESP. However, use of international radio observatory facilities for the ESP will require proposals submitted well in advance by the Early Science Program Team (ESPT) to the individual observatories for peer review. Organizations which have made contributions to the mission will be asked to appoint scientists to participate in the ESP in recognition of the work done by those individuals for the mission development and operation.

After the ESP period there will be observations for *Key Science Programs* (KSP) with each KSP representing a different important areas of scientific research program for the mission. KSP teams should be formed in advance to the launch. Scientists may participate in the KSPs by responding to an announcement of opportunity (AO) issued before the launch date. KSPs may continue during the whole mission as appropriate.

After the commissioning phase, a yearly series of AO's for individual investigators will be issued by the Mission for the observing period starting after the ESP phase (about one year after launch date). It is expected that in the equilibrium stage of mission operation there will be approximately equal observing time allocated for individual programs and for KSPs.

It was agreed to create the RadioAstron Science Program Working Group (RSPWG) with Lobanov and Popov as co-chairs. The RSPWG will develop a set of recommendations concerning the execution and implementation of ESPs, KSPs, and the AOs. It is planned to issue a first AO in 2009 for both PI-driven and KSP programs with details to be provided by the RSPWG.

The mission will need to prepare a RA Observers Manual with the first draft available by April 1, 2009.

4. In-Orbit-Checkout (IOC)

With the planned launch date in November/December 2009, the first IOC observations in interferometric mode are expected in March/April 2010. An IOC team will need to be formed as soon as possible to plan for the IOC phase. The IOC team is expected to submit observing proposals to several big ground radio telescopes (GBT, Effelsberg, WSRT, DSN) to request observing time for the first VLBI trimester 2010-T1. The deadline for such proposals is October 1, 2009. The IOC mission plan is to use Russian ground radio telescopes for the first fringe searching, but observing time at the large international radio telescopes will be necessary, especially at 22 GHz. The required amount of observing time at the large international radio telescopes may be about 12 hours in each frequency band, divided into

three or four 2 to 3 hours sessions each separated by 10-15 days for processing and analysis.

It was recommended that the Mission prepares and submits proposals for ground support of the IOC observations.

5. Access to ground radio telescopes

With the launch date in November/December 2009, the IOC phase will occur in the first VLBI observing trimester (2010-T1), with ESP following in 2010-T2, and the first open observing period following in 2010-T3, i.e. from October 1, 2010. To obtain observing time for the 2010-T3 trimester, PIs will have to submit their proposal to observatories (or networks) by Feb. 1, 2010, so that after the decision of the ground radio telescopes there will be enough time for the RadioAstron Mission Scheduling Team (RMST) to schedule the approved proposals. ESP and KSP teams will have access to ground radio telescopes on the basis of separate agreements between the Mission and the observatories. In particular, radio telescopes in Russia will be used on such basis.

6. Proposal Evaluation.

It was recommended that the RadioAstron Proposal Evaluation Committee (RPEC) should check the technical feasibility and evaluate the potential impact of all proposals, before they are submitted to ground radio observatories. It is expected that all proposals approved by RPEC and ground observatories will be scheduled for RadioAstron observations.

7. RadioAstron Announcement of Opportunity and Observers Manual (RAO and ROM)

RAO and ROM have to be timely issued by the Mission. First drafts of these documents will be presented in April 2009.

8. Scheduling of the observation

According to the Mission Operations Plan there will be a long-term 4-months schedule (LTS) for a given trimester, and a short-term schedule (STS) for the current 5 weeks. The STS will be updated every week. The LTS and the STS are in a form of SRS files in the same format as used by the VSOP mission. It was recommended that RadioAstron Mission Scheduling Team (RMST) should create observing schedules for all ground radio telescopes using the SCHED software.

9. Data Correlation

Likhachev explained that ASC plans to use a 5-stations software correlator for correlation of the RadioAstron observations. He suggested that it would be very useful if any other institution (e.g. NRAO or MPIfR) could duplicate the data processing in order to compare results of the correlation. Currently the ASC correlator is involved in the testing correlations of ground-based observations to test all functionalities (?) and to reveal possible errors and faults. Any raw ground-based VLBI datasets for testing are welcome at ASC.

10. Compatibility of recording systems

Since the ASC is going to use a RDR-1 recorder for Russian ground-based radio telescopes,

data compatibility will be an issue. The ASC plans to purchase (at the end of 2008) one Mk-5C recorder and to use it as a copy machine to obtain data compatibility with the international VLBI community.

11. Mission operations

Popov informed that Mission operations will be carried out by the ASC RadioAstron Mission Scheduling Team (RMST), in close interaction with the General Operative Control Group (GOCG) of LA. The RMST will create Long-Term Schedules (LTS) in the standard format of Space Radio Telescope Schedule files (SRS) for every trimester (four months). GOCG will convert the SRS commands into spacecraft operation commands. Mission operations are described in RadioAstron Mission Operation Handbook (RMOH). It may be found at the ASC web site http://www.asc.rssi.ru/RadioAstron/documents/rmoh/eng/contents.htm

12. The RISC members expressed their pleasure with the apparent readiness of the RadioAstron spacecraft and the instrumentation for a late 2009 launch. Concerns were expressed that any further delays ostensibly due to the status of the Electra mission would destroy the remaining credibility of the RadioAstron Mission. The RISC encourages the RPL to proceed with arranging the critically needed international support for tracking and ground-based observing.

A P P E N D I C E S

(A) List of action items.

Action items

RadioAstron International Science *Advisory* Council (RISC) meeting on October 24, 2008

Prepared by Yuri Y. Kovalev

Version 2.0

RISC members present: see Minutes.

1. **William Baan, Misha Popov:** update the Terms of reference following the notes taken during the RISC 2008 meeting. Distribute to the RISC members for comments by the *end of Nov 2008*. Put the final version on the RA web, distribute it around the RISC members by the *middle of Dec 2008*.
2. **Andrei Lobanov, Misha Popov, RSPWG** (RadioAstron Science Program Working Group)**:**
    a) A set of recommendations concerning the scientific program, Key Science Programs (KSP), announcement of Opportunity to be formed by the *end of November 2008* and distributed around the RISC for comments.
    b) An announcement of opportunity draft to be prepared and distributed around the RISC members and key radio observatory directors by *Jan 1, 2009* for discussion/comments.
    c) The final version of the AO1 to be announced by *June 1, 2009,* by the **Mission**.
3. **Misha Popov, Mission:** Prepare the RA Observer's guide by *April 1, 2009,* for comments of RSPWG, RISC, key radio observatories directors. Final draft to be put on the RA web by *June 1, 2008.*
4. **RISC members:** check on the RadioAstron web content (http://RadioAstron.ru/) and send your comments to Nikolai Kardashev (nkardash@asc.rssi.ru) and Vladimir Yakimov

(yakimov@asc.rssi.ru).

5. **Mission:** look into possibility and logistics for outsiders to attend the launch.
6. **RISC:** consider at a later point the question regarding the data ownership policy.
7. **Yuri Kovalev:** work on the RadioAstron symposium picture gallery.
8. **RISC members:** presentations and memos regarding current RadioAstron status at home institutes.
9. **Mission:** prepare and submit proposals for ground support for the in orbit check out (requires large radio telescopes) *by October 2009 (subject to the launch date.*
10. **Yuri Kovalev:** provide raw EVN data to SL for the ASC correlator checks through JIVE support (Bob Campbell). *By December 2008 / January 2009.*
11. **Yuri Kovalev:** start monthly RadioAstron newsletter series.
12. **Nikolai Kardashev:** continue working on RISC membership. Contact people which were suggested but not present. *By November 2008.*
13. **Sergey Likhachev:** organize RadioAstron Technical Working Group (RTWG) meeting in 2009. Start planning in *November 2008.*
14. **RISC secretary (Misha Popov):** prepare RISC 2008 minutes *by middle of November 2008*. Send for comments to Ken Kellermann, then all the RISC 2008 meeting participants.

(B) Terms of References

THE RADIOASTRON IINTERNATIONAL SCIENCE ADVISORY COUNCIL (RISC) TERMS OF REFERENCE

The *RadioAstron International Science Advisory Council* (RISC) is an international science committee established to oversee the preparation, implementation and science operation of the RadioAstron Project.

The *RadioAstron Project* (herein the Project) is a Space VLBI system that consists of three interacting components:

1. The *Engineering Component* includes the spacecraft SPEKTR-R with a science payload including the Space Radio Telescope (SRT), operational resources, data acquisition systems, ground data processing facilities, and other resources under the control of the *Russian Project Leadership* (herein the RPL). Tracking Stations and VLBI networks and stations located in other countries are under the control of those other countries and may participate in the Project in accordance with bilateral agreements with the Russian Space Agency or/and the Russian Academy of Sciences.
2. The *Scientific Component* includes all scientific and technical activities associated with carrying out astronomical and other scientific observations using the RadioAstron spacecraft and all other associated ground resources.
3. The *Organizational Component* includes all activities directed to provide and promote the efficient development and implementation of the Project.

Participating Agencies (PA's) are national or international entities that have contributed or will contribute resources to the Project. The PA's will normally have international agreements with the Russian government institutions that commit resources to the Project. Organizations such as radio observatories or telescope networks may serve as a separate PA.

1 RESPONSIBILITIES AND DUTIES

RPL and the PA's are to coordinate their activities with the RISC in all activity areas listed below in

this document. RPL will inform the RISC about the relevant decisions taken in the Project development.

The RISC advises on the *scientific strategy of the Project* and makes recommendations for the implementation of this strategy. The RISC is authorized to consider the following areas:

1.1 the scientific profile of the Project;
1.2 the Key Science Programs for the Project;
1.3 the resolution of conflicts in the scheduling of scientific observations and experiments;
1.4 the development of a policy on data ownership, publication rights, and archiving of the scientific data and other results; and
1.5 the publications of Announcements of Opportunity for scientific use of the Project.

The RISC advises on the *science management* of the Project and makes recommendation in this area. The RISC is authorized to consider the following areas:

1.6 the formation of international working groups necessary for Project development and implementation;
1.7 the formation of scientific working groups to carry out key science programs;
1.8 the nomination of referees to evaluate of scientific proposals;
1.9 the nomination of members to the Program Evaluating Committee;
1.10 the negotiations with international institutions to provide funding or other resources needed for Project development; and
1.11 the RISC membership.

2 PROCEDURES

RISC will meet regularly (with a target of one or two meetings per year) until the termination of the Project. A meeting will be chaired by one of the co-chairpersons.
A quorum of at least 50% plus one of the total membership is required to hold a valid meeting. The
Secretary will determine well in advance of a meeting whether a quorum of members is likely to attend.
The Secretary will administer any votes during the meetings. A 50% plus one majority of the members present is needed for any motion to pass.
RISC meetings by teleconference can be held as required between the regular annual meetings.

3 MEMBERSHIP AND ORGANIZATION

Members of the RISC can be RPL- and PA-representatives and independent scientists.
Independent scientists are appointed by the chairs and participate in the RISC on the basis of a recognized and long-standing experience in VLBI or space research. The membership and organization of the RISC will be determined according to the following rules:

3.1 RISC will have two Co-Chairpersons: a Permanent Co-Chairperson, who is the Scientific Leader of the Project, and a Co-Chairperson (herein RISC Co-Chair), who serves for a two-year period.
3.1.1. The Permanent Co-Chairperson will serve in that capacity as long as he/she holds the position of Scientific Leader of the Project. The Permanent Co-Chairperson is not elected.
3.1.2. The RISC Co-Chairperson is elected by a 67% majority vote of the RISC foreign membership every two years.
3.2 One RISC member is nominated by the RISC as a Secretary. This nomination has to be approved by a majority vote of 67% of the total RISC membership. The Secretary is responsible for keeping minutes of meetings, issuing notices of meetings, distributing documentation of interest to the RISC, recording votes, and other organizational duties as may be required by the RISC Co-

chairpersons. The Secretary will also keep an official list of members and of PA's.
3.3 Individual members may propose to be represented by a substitute during RISC meetings. These substitute attendees will have the same privileges as the regular members during the meeting. Substitutes should be reconfirmed for each single meeting separately.
3.4 The RISC must approve all new members by a vote of 50% plus one of the total RISC membership.
3.5 A termination of RISC membership may result from: a) a written resignation by I did the member, (b) a recall of the representative by the nominating PA, or (c) a direct initiative by the RISC. 3.6. Reasonable effort will be made to limit RISC membership to no more than 30.

4 CHANGES TO THE TERMS OF REFERENCE OF THE RISC

The Terms of Reference may be altered by a vote of the total RISC membership on a Motion to change these Terms of Reference. The Motion must be presented in writing to all members of RISC at least one month in advance of a RISC meeting. The Motion must be discussed at the meeting, and a vote held by mail or other secure form of communication within one month of the meeting. The Motion must pass by a majority vote of 67% of the total membership.

(C) Agenda of the Symposium "Radio Universe at Ultimate Angular Resolution"

Monday, October 20
Morning Session
Chairman: W. Baan
09:30 K. Kellermann: Brightness Temperature Limits of Compact Radio Sources (25+5)
10:00 N. Kardashev: Some Critical Experiments with RadioAstron (25+5)
10:30 D. Jauncey: IDV Variable Radio Sources (25+5)
11:00 Y.Y. Kovalev: RadioAstron Survey to Probe AGN Jets at Fine Scales (25+5)
11:30 – 12:00 Coffee Break
12:00 G. Giovannini: New Results on the Parsec Scale Properties of Submilliarcsecond Structures in Extragalactic Radio Sources (15+5) 12:20 D. Gabuzda: High-Resolution RadioAstron Polarization Observations with Limited Imaging (25+5)
12:50 G. Cimo: Two-dimentional Time Delay Measurements of Fast Scintillator Using VLBI Arrays (15+5)
13:10 L. Gurvits: Redshift-Dependent Properties of Submilliarcsecond Structures in Extragalactic Radio Sources (15+5)

13:30 – 15:00 Lunch Break
Afternoon Session
Chairman: K. Kellermann
15:00 Y. Gnedin, M. Piotrovich, T. Natsvlishvili: Magnetic Fields of Quasars and Active Galactic Nuclei (25+5)
15:30 A. Lobanov: Studies of Ultracompact Jets with RadioAstron (25+5)
16:00 A. Pushkarev, Y.Y. Kovalev: Adiabatic Expansion and Magnetic Fields in Parsec-Scale AGN Jets (15+5)
16:20 Y.A. Kovalev, Y.Y. Kovalev, N. Nizhelsky, G. Zhekanis.: RATAN-600 Continuum Spectra as a Tool to Select Promising AGN Jets for RadioAstron Studies (15+5)
16:40 N. Bartel: Supernova VLBI with RadioAstron (25+5)
17:10 – 17:40 Coffee Break
17:40 K. Postnov: Radio Emission from Cosmic Gamma-Ray Bursts (15+5)
17:50 W. Baan: OH Masers, OH Megamasers, and Nuclear Starburst (25+5)
18:20 Y. Hagiwara: Water Megamaser Observations with Space-VLBI (25+5) 18:50 M. Garrett,

H. Ramparadath, E. Lenc, O. Wucknitz, S. Tingay : An “Adhoc” VLBA 327MHz Survey (15+5)

Tuesday, October 21
Morning session
Chairman: D. Jauncey
10:00 C. Gwinn: Scintillating Pulsars (25+5)
10:30 V. Shishov: Interstellar Scintillations and Nanosecond Resolution in Radio Astronomy (25+5)
11:00 V. Beskin: Radio Pulsars: What Is To Be Done? (25+5)
11:30 M. Popov, Y. Ilyasov, V. Zharov: Giant Radio Pulses from the Crab Pulsar as a Calibrator Tool for SVLBI(25+5) *11:30 – 12:00 Coffee Break* 12:00 A. Serber, G. Tsarevsky: The Nature of Very Active RS CVn Type Stars and the Possible Identification of its Highly Polarized Emitter (25+5) 12:30 N. Bartel: A Test of the Gravitational Redshift with RadioAstron (25+5) 13:00 V. Zharov, Y. Ponamarev: Astrometric Goals of RadioAstron Mission (25+5) *14:00 – 15:00 Lunch Break*
Afternoon Session
Chairman: M.Garrett
15:30 I. Novikov: Wormholes in the Universe and Some Methods of Their Search (25+5)
16:00 S. Blinnikov: Miror Matter as a Form of Dark Matter and RadioAstron (25+5)
16:30 A. Doroshkevich: Formation, Evolution and Observational Evidences of Super Massive Black Holes (25+5) *17:00 – 17:30 Coffee Break*
Afternoon Session continues
17:30 V. Lukas, B. Stern: How Can Dark Energy Be Measured, Particularly, at Fine Angular Resolution (25+5)
18:00 G. Bisnovatyi-Kogan: Gravitational Radio Spectrometer (25+5)
18:30 A. Tuntsov, M. Pshirkov: Probing Substructure Lensing with RadioAstron (25+5)

Wednesday, October 22
Visit to Lavochkin Assosiation
10:10-11:00 visit to the workshops
11:00 – 12:00 Technical Session
Chairman: G. Polishuk
11:00 Y. Nosenko, G. Polishuk: RadioAstron Mission on its Way to Launch (15+5)
11:20 V. Babyshkin: Spacecraft Bus NAVIGATOR for RadioAstron (15+5)
11:40 N.Babakin et al.: Tests of the SRT Construction (15+5)
12:00-12:30 Coffee Break
12:30 K. Sukhanov et al.: RadioAstron Mission Operation and Control (15+5)
12:50 A. Belyaev et al.: On-Board Hydrogen Frequency Standard (15+5)
13:10 E.Akim , R.Bebenin,Y. Ponomarev, V. Stepanyans, A., Tuchin: Navigation of the High-Apogee Orbit of the SRT in RadioAstron Mission (15+5) 13:30 A. Sheikhet: Synthesis of the Spacecraft Orbit for Space-Ground Interferometer (10+5) 13:45 V. Shargorodski et al.: Orbital Measurements by Laser Technique(15+5) 14:05 A. Chebotarev et al.: The Bear Lake Control Station and Kalyazin Radio Telescope (15+5) 14:25 V. Kolesnikov et al**:** The Ussuriisk Control Station and Radio Telescope (15+5) *14:45 – 15:45 Lunch*

Thursday, October 23
Sessions at the ASC
Chairman: Y. Ilyasov
10:00 V. Andreyanov, B. Kanevsky et al.: RadioAstron Science Payload Status and Main Parameters. On-board VIRK Complex. (15+5) 10:20 B. Kanevsky, A. Smirnov:

Pushchino Tracking Station (15+5)\ 10:50 A. Biryukov, B. Novikov et al.: Results of Testing On-Board and Ground Segments of
Space Interferometer (15+5) *11:10 – 11:40 Coffee Break* 11:40 G. Langston: Design of Transient Event Detectors for Science Data Tracking Station IS in
Green Bank (25+5) 12:10 S. Likhachev: RadioAstron Digital Data Processing at the ASC (25+5) 12:40 Y.Y. Kovalev: Pre-Launch Test Observations in MFS Mode (15+5) 13:00 M. Larionov, M. Popov: Ground Radio Telescope Network in Russia (15+5) *13:20 – 15:00 Lunch Break*

Afternoon session

Chairman: B.Burke

15:00 Y. Hagiwara (Y. Murata): The ASTRO-G (VSOP-2) Project (25+5)
15:20 A. Ipatov: QUASAR Network in RadioAstron (15+5)
15:40 A. Tzioumis: Recent Developments with LBA (15+5)
16:00 A. Bajkova: Multi-Frequency Synthesis Technique in Radio Interferometric Imaging Using
Generalized Maximum Entropy Method (15+5) 16:20 L. Kogan: Some Special Aspects of Imaging at Space VLBI (15+5) 16:40 M. Mingaliev, Y. Sotnikova, N. Kardashev and M. Larionov: Spectral Properties and
Variability of Radio Sources near the North Celestial Pole (15+5) 17:00 V. Vasil'kov, Y. A. Kovalev, M. Larionov, A. Kovalenko, N. Nikolaev: Prelaunch Antenna Parameters of SRT-10 from Measurements and Estimations (15+5) 17:30 L. Matveenko: The Fine Structure of the Ejector Regions and Jets (15+5) *17:30 – conference dinner*

Friday, October 24

Sessions at the ASC

10:30 – 11:00 Visit to the laboratory testing of the flight models of science payload
11:00 – 11:30 Coffee Break
11:30 – 14:00 **RISC Business Session**

(D) List of participants of the Symposium

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