FOTON M-3
Non-Advocate Review (NAR) Committee
Questions to the Investigators
May 2006

The Foton M-3 Review Committee held a teleconference on Friday, May 23, 2006, to discuss the four proposed US experiments. Committee members were helped by the supplemental information provided as requested from the Pis and NASA personnel regarding the M2 flight results, environmental conditions, and hardware capabilities available for M3. The committee would like to express their appreciation to the Pis for the rapid and forthcoming responses. From the available information, the committee was unified in both their approval and concerns regarding the individual projects and the mission as a whole. According to the NAR-M3 Committee Charge, the evaluation should contain a number of elements. The first component was to review the results from the previous M2 experiments. The second component is to provide a set of guidelines and recommendations for the Pis, so as to maximize the scientific yield. The third component, is to serve as a steering committee to the Pis and NASA throughout the preparatory and potential M3 flight phases of the project, so as to optimize the research effort.

In the current report, the committee would like to provide initial assessments as to the available results from the M2 mission and to provide a set of recommendations for research related to a potential M3 project.

General Recommendations:

Deemed Essential for Project Success:

1. All Experiments: Perform asynchronous ground controls for all experiments after relevant flight environmental conditions are known, including temperature, lighting, humidity, etc. If downlink information for environmental parameters are not available, asynchronous control runs should be performed following the flight, once the flight data have been collected. The goal is to replicate as closely as possible in the asynchronous controls, all environmental conditions experienced by the animals during flight.
2. All Experiments: Environmental chambers for each experiment should be thoroughly tested in ground experiments before a potential M3 flight. The experiment design goal should be to minimize to the extent possible differences in any measured variable, e.g weight gain, stress hormone levels, activity, between animals in normal lab and flight-type chambers. No tissue degradation or physiologic response changes should be induced by the flight chamber per se. Only then, can effects due to spaceflight conditions be scientifically interpretable.
3. Gecko & Newt: We strongly recommend that behavioral monitoring of the animals be done during the M3 flight. Possible choices include: battery powered infrared cameras (programmed for either still or motion shots at specific times each flight day), stress hormone monitoring through serum examination before and after flight.
4. All Experiments: Rapid recovery of flight samples upon landing. Arrest colonies and animals from re-adaptation through cooling. Return samples to Pi's in as short as time as possible, ideally six hours or less.

Deemed Valuable for Project Success:

1. Gecko & Newt: Perform parabolic flight experiments for all animal studies with flight-type experiment containers being utilized. Observe animal behavior.
2. All Experiments: Place temperature and, if possible, humidity sensors in or near animal habitats, with frequent data collection several times/day. Store data or downlink for asynchronous control.

Specific Recommendations - Plasmid

1. In general, the science of the Plasmid experiment remains of high quality and relevant

to NASA's goals. The results from the M-2 experiment have provided observations that the system should work if (1) the Foton temperature achieves nominal ranges and (2) subsequent sample retrieval is completed in a more successful fashion. The investigator's decision to repeat the experiment as it was originally designed is appropriate.

2. The greatest risk is the temperature in the Foton. The quality of science may range from excellent information (if the temperature holds at nominal levels) to non-conclusive work (if the temperature drops to 15C,as occurred during the M2 flight).

Specific Recommendations - Gecko & Newt Experiments:

1. Gecko: A preliminary draft report describing the findings from the M2 project state that rapid catabolism of cancellous in geckos was observed for both asynchronous and flight housing conditions as compared to basal controls. This leads to serious concerns regarding the gecko experiments and unless the housing conditions are corrected so normative values remain for ground control animalsit is unlikely that meaningful data can be obtained.

2. Gecko: Serious concerns regarding the health and welfare of the vertebrates during the flight remain. Other than subjective reports stating that the animals survived and demonstrated good appetite post-flight, little is known about the health status. This concern is important at several levels. For example, during the initial exposure to microgravity, parabolic flight studies have shown that many lizards exhibit substantial activity increases with behaviors that are atypical to those seen in normal g conditions (e.g., spinning, wild convulsive posturing, free-fall stretches). These activities could rapidly lead to exhaustion and/or lactic acidosis that will certainly affect many of the experimental flight findings. Some information regarding the activity level during the flight must be known for valid comparisons and data interpretability. From the available data for M2, all we know about the condition of the newts and geckos postflight is that they survived, but little else. This is clearly inadequate and makes the findings impossible to evaluate. No primary data were given to this review committee regarding the health or condition of the newts and geckos following flight. Body weights, general condition, skin condition, hydrated or dehydrated, etc, are all factors which can alter the outcomes being analyzed. Overall, information regarding the health and welfare of amphibians and reptiles during the previous flight was not available but should be. Future flights should included such monitoring.

3. Gecko & Newt: Nowhere in the reports of the M-2 flight do we have any data reporting the relative condition of the flight animals versus those in the ground control group. We don't even know if the flight animals weighed more or less than the ground control animals. Without knowing more about the general condition of the flight animals, to give us confidence that the flight and control animals were comparably healthy, there is no way to make any sense of data on cell proliferation or regeneration rates. It also appears that the body weight of the newts used as synchronous controls was substantially lower than the weights of the newts in any other group. The SC group mean weight was 5.2 grams compared to 7.2 grams for basal controls and 8.65 grams for the flight group. Such a difference can make a large difference in body responses and seems to be a variable that could, and should, be controlled.

4. Gecko & Newt: In order to evaluate the animals response to micro-g, it is strongly advised that preliminary parabolic flight observations be made.

Some form of video monitoring is deemed essential.

5. Gecko & Newt: It is recommended that stress hormone levels be monitored, possibly through serum levels. A recent article in Anat.Embryol, (2006) April 22, shows that it

is possible to measure serum values of aldosterone, corticosterone and epinephrine in newts.

6. Gecko & Newt: uCT comparisons are difficult especially when comparing bones of different sizes. We suggest that a mix of flight and ground control bones be analyzed together so that any corrections made during the uCT scan will be equally applied to all tissues.
7. Gecko & Newt: M2 flight results suggesting a larger bone volume in the flight animals need to be carefully analyzed and justified. In general, Bone Volume/Tissue Volume is considered an important measurement and this ratio was not seen to change with flight. The final results of the uCT need to be collected before statements about differences between the newts and geckos are made. To test the hypothesis of "lost bone mass," the bone data need to be adjusted to the overall weight loss of animal. In addition, whether bone mineral mass loss occurs during flight depends on whether the bones were unloaded, which could have happened if the animals floated freely. However animals housed in groups do not normally float freely. Rather mammals and lizards typically hold on to each other in micro-g, when housed together. Without monitoring behavior, it is unknown what the animals actually did during M2 or will do during M3.
8. Newt: The delivery system for BrdU is difficult to quantify. The amount of uptake and at what times during the exposure needs to be determined. Does the weightless environment permit label exchange since there was no real circulation of the aqueous environment except for animal movement and weightless animals may not move very much? It is recommended that the BrdU dosage be increased, decrease BrdU delivery time, and enhance delivery method. The value of the BrdU experiment would be better appreciated if we were given the data on BrdU uptake for the 18 flight animals flown on M-2. This would provide a standard deviation and the question of consistency using this methodology.
9. Newt: The localization of BrdU seems to be made more difficult than necessary. Instead of using a conjugated antibody with peroxidase (which resembles the pigment that is confounding the analysis) one could use a alkaline phosphatase conjugate (bright red; no conflict with pigment) or fluorescent conjugate (bright green or any fluorescent color which does not compete with pigment). These are easily obtained commercially and are standard procedures in many laboratories.
10. Newt: Proper irradiation dose for newts may not be known. Using human exposure levels may not be appropriate for these model animals. Is there any information on these or other animals which can be used to make appropriate tests for radiation damage?
11. Newt: How can the irradiation dose for the cell culture studies be determined, so as to permit comparisons to the whole animal studies? Or are you not interested in this comparison?
12. Newt: Could analysis by flow cytometry be added value? One could evaluate cell cycle changes, apoptosis and other cellular events in a more quantitative way. It appears that you may evaluate ROS by flow cytometry, so why not add consider flow for analysis of other cellular events?
13. Newt: There are other reports indicating that cell proliferation is enhanced during spaceflight, as this study seems to indicate. However, unless this additional cell population goes on to differentiate, the overall effect may not be very important. Consider permitting some of the flight animals to continue growth for a few days after return to earth, to see if the tissue regeneration and growth is actually accelerated and if

fully differentiated tissue forms.

14. Newt: Temperature control would seem to be even more important in this project than M-2. And temperature and environmental controls are critical to the final understanding of determining whether irradiation or whether flight (weightlessness, microgravity) were the primary causes of any alterations found following flight. If these conditions cannot be controlled during flight, then they should at least be monitored so that a delayed asynchronous control study could be performed as part of this project.

Specific Recommendations - Receptor

1. For the gene expression studies, it is of interest to examine the preproHPep gene, although it's role in statocyst cell function is unknown at present. From the M2 flight results, it is possible that the upregulation observed post-flight could be due to either temperature reduction (cooling to reduce activity after landing), recovery adaptation (30 hours) to 1g, or to micro-g exposure. It is recommended that some temperature reduction, hypergravity and neutral buoyancy experiments be performed prior to M3 to try to tease apart the possible causes for up-regulation in mRNA expression.
2. (Incorrect assessment of animal deaths by the NAR Committee): The loss of a number of snails in the asynchronous ground control habitat was a concern. Of the 20 animals initially housed, only 8 survived or were in good condition as observed. It was postulated that the remaining animals died or were sick due to dehydration. Several issues arise. First, were the remaining 8 snails also dehydrated and if so, the control comparisons may be invalid. It is recommended that the ground control exposures be redone, this time with appropriate temperature regulation as was actually experienced during the M2 mission for a more appropriate comparison. Second, it is recommended that some form of monitoring humidity be implemented for the ground and M3 flight exposure animals.
3. Depending upon the amount of down-link environmental data during the flight. It is recommended that all asynchronous ground controls be delayed until the actual flight exposure parameters are known. Then, these conditions be replicated for the control animals.
4. Activity levels during the flight could affect all measures, as is well appreciated by the Pis. It is felt that some form of in-flight monitoring (video monitoring) be implemented with identification markings on each snail to provide data for activity levels for all animals.

Version Control - This reflects edits on June 15, 2006 by Mike Skidmore and Ken Sousa to the draft document (NASA-IMBP Foton-M3 Agreement 6 14 06.doc) provided by Stephen Ballard

AGREEMENT BETWEEN THE RUSSIAN FEDERATION STATE RESEARCH CENTER INSTITUTE OF BIOMEDICAL PROBLEMS OF THE RUSSIAN ACADEMY OF SCIENCES AND THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OF THE UNITED STATES OF AMERICA CONCERNING SCIENTIFIC COOPERATION ON THE FOTON-M3 MISSION

The Ninth meeting of the U.S.-Russia Joint Working Group on Space Biomedicine, Life

Support Systems, and Microgravity Studies (JWG) was held in Moscow, Russia, on October 31 - November 2, 2005. The JWG was established to advance the goals and objectives of the June 17, 1992, *Agreement between the United States of America and the Russian Federation Concerning Cooperation on the Exploration and Uses of Outer Space for Peaceful Purposes* that were further outlined in the summary of discussions pertaining to cooperation in space exploration held in Moscow in July 1992. The Ninth JWG reviewed the status of preparations for Russian Federation (RF) State Research Center (SRC)-Institute of Biomedical Problems (IMBP), Russian Academy of Sciences' biology experiments to be flown in space for 12 days on the Russian Federal Space Agency's (Roscosmos) Foton-M3 spacecraft. Foton-M3, to be launched in September 2007, will be a joint Roscosmos-European Space Agency mission and will include IMBP participation. The JWG reconfirmed IMBP and NASA interest in continuing the collaboration in pre- and post-flight investigations conducted on biological subjects such as snails, newts, lizards, and microorganisms that was begun with the 2005 Foton-M2 mission.

As stated in paragraph 3.4 of the Ninth JWG's Protocol: "the Russian side invited the U.S. side to explore the possibilities of participating in the Foton-M3 project. The U.S. side agreed to study this proposal and to provide a response as soon as possible". In a letter dated February 15, 2006. the Director of IMBP reiterated that invitation to the U.S: National Aeronautics and Space Administration (NASA). Considering the high science productivity of the bilateral cooperation in space biology research performed on nine Bion satellites from 1975 to 1997, the highly productive NASA-IMBP cooperation on the 2005 Foton-M2 scientific activity, as well as the interest in furthering mutually beneficial cooperation in the solution of space biology and medicine problems, NASA responded in a letter dated March, 30, 2006, that it intended to participate in the Foton-M3 mission pending conclusion of a requisite international agreement. This document is that agreement (hereinafter referred to as "the Agreement").

To implement this cooperation, IMBP and NASA, hereinafter referred to as "the Parties," plan to collaborate on experiments (hereinafter referred to as "the Experiments").

Article 1 - Responsibilities

IMBP shall use reasonable efforts to carry out the following responsibilities:

1. Select a Russian Principal Investigator for each Experiment;
2. Jointly with NASA, develop experimental design, techniques, and procedures for the collaborative portion of the Foton-M3 experiments;
3. Jointly with NASA, develop Experiment Management Plans for each Experiment that include experimental protocols, detailed lists of tissues to be shared, and detailed lists of items that will be cooperatively shared;
4. Transfer to NASA pre- and post-flight biological specimens from biological subjects flown in space and used as ground controls as required to support experiment protocols;

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5. Conduct flight experiments on the Foton M-3 with specimens for each Experiment;
6. Provide NASA with pre- and post-flight biological specimens from biological subjects flown in space, as mutually agreed in each EMP;
7. Provide NASA with biordgicakspecimens from ground studies for each Experiment, as mutually aijeeed in eacй EMP;
8. Provide Russian customs support :: In accordance with.... => do we need to speciafy the US/Russian agreement on customs support:: by supplying the following;

    a. Shipping information necessary for shipment from Moscow into the U.S of preflight biosamples for each Experiment.

    b. Documentation necessary for shipment from the U.S. to Moscow of Temporary Laboratory Items. The timing of the customs support and shipping activities shall be

jointly determined such that all equipment is in place and available to support activities specified in each Experiment Management Plan (EMP).

c. Support and documentation necessary for shipment from Moscow to the U.S of the flight and control specimens for each Experiment, as mutually agreed in each EMP.

9. Jointly, analyze the biological specimens and experimental data;

10. Jointly with NASA, publish the results of the research activities as specified in Article 9;

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11. Provide NASA with flight retpet data for each Experiment within 20 days of Foton-M3 re-entry module's landing and recovery. Flight research data shall include, but may not be limited to environmental parameters of the flight and control specimen;

12. Participate in an initial post-flight review of results from each Experiment within three (3) months of recovery and a final results science meeting within nine to twelve (9-12) months of recovery as mutually agreed in each EMP.

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13. Obtain the technical support and payload integration services from the spacecraft manufacturer, the State Research and Production Space Rocketry Center TsSKB-Progress, Samara, Russia.

NASA shall use reasonable efforts to carry out the following responsibilities:

1. Select a U.S. Principle Investigator for each Experiment;
2. Jointly with IMBP, develop experimental design, techniques, and procedures;
3. Jointly with IMBP, develop Experiment Management Plans for each Experiment that include experimental protocols, detailed lists of tissues to be shared, procedures for sharing tissues, and detailed lists of items that will be cooperatively shared;
4. Provide specifications for NASA required biological subjects;
5. Supply the Temporary Laboratory Items to IMBP for each Experiment on a schedule and location as mutually agreed in each EMP;
6. Participate in pre- and post-llighl science procedures in Russia for each Experiment as Amutually agreed in each EMP;
7. Support collection, preservation, and shipment of preflight biosamples for each Experiment, as mutually agreed in each EMP;
8. Ship from Moscow to the U.S., via NASA-provided biotransporters, the IMBP-provided pre- and post-flight biological specimens for each Experiment for analysis in US laboratories;
9. Assist Russian specialists in preparation of flight specimens for transport to the launch site as specified in each EMT;
10. Support synchronous and/or delayed synchronous ground control studies as specified in each EMP; and

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::Redundant with 8::

11. Participate in an initial post-flight review of results from each Experiment within three (3) months of recovery and a final results science meeting within nine to twelve (9-12) months of Foton-M3 reentry module recovery as agreed in each EMP.

Article 2 - Experiments, Principal Investigators and Participating Organizations

1. Lead organizations responsible for technical implementation of the Experiments shall' be IMBP and the NASA/Ames Research Center (ARC).
2. The Experiments. Pis. and participating organizations shall be:

Receptor-F3 (snails)	
Balaban. Pavel M.	Richard D. Boyle

Institute of Higher Nervous Activity and Neurophysiology (IHNAN). Russian Academy of Sciences) -RF SRC - IMBP, Moscow. Russia	NASA Ames Research Center. CA. USA
Regeneration-F3 (newts)	
Victor I. Mitashov	Eduardo A.C. Almeida
Koltsov Institute of Developmental Biology, Russian Academy of Sciences; RF SRC- IMBP, Moscow, Russia	NASA Ames Research Center, CA, USA
Gecko-F3 (lizards)	
Segei V. Savelyev	Eduardo A.C. Almeida
Institute of Human Morphology, Russian Academy of Medical Sciences; RF SRC -IMBP, Moscow, Russia	NASA Ames Research Center, CA, USA
Plasmid-F3 (microorganisms)	
Tatiana A. Voeikova	Barry H. Pyle
Genetics Research Center; RF SRC -IMBP, Moscow, Russia	Montana State University, Bozeman, Montana, USA

Article 3 - Points of Contact

The IMBP Program:

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The IMBP

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The IMBP Administrative Point of Contact shall be:

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Email: info@imrbp.ru

The NASA Management Point of Contact shall be:

Exploration Systems Mission Directorate
NASA Headquarters
300 E. Street SW
Washington DC, 20546
Tel: +1 202-358-_____
Fax: +1 202-358-_____
Email: _____

The NASA Technical Point of Contact shall be:

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NASA Foton-M3 Project Manager
NASA Ames Research Center
MS 240-10
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Fax: +1 650-604-4503
Email: Mike.Skidmore@nasa.gov

The NASA Administrative Point of Contact shall be:

Mr. Stephen E. Ballard
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Fax: +1 202-358-3030
Email: Stephen.E.Ballard@nasa.gov

The Parties further agree to extend this cross-waiver to its own related entities by requiring them, by contract or otherwise, to waive all claims against the other Party, related entities of the other Party and employees of the other Party or of their related entities for injury, death, damage, or loss arising from or related to activities undertaken pursuant to this Agreement.

Article 7 - Transfer of Goods and Technical Data

The Parties are obligated to transfer only those technical data (including software) and goods necessary to fulfill their respective responsibilities under this Agreement, in accordance with the following provisions, notwithstanding any other provisions of this Agreement.

1. All activities of the Parties shall be carried out in accordance with their national laws and regulations pertaining to export control or control of classified information.

2. The transfer of technical data for the purpose of discharging the Parties' responsibilities with regard to interface, integration, and safety shall normally be made without restriction, except as provided in paragraph 1 above.

3. All transfers of goods and proprietary or export-controlled technical data are subject to the following provisions. In the event a Party or its related entity finds it necessary to transfer goods or to transfer proprietary or export-controlled technical data, for which protection is to be maintained, such goods shall be specifically identified and such proprietary or export-controlled technical data shall be marked. The identification for goods and the marking on proprietary or export- controlled technical data shall indicate that the goods and proprietary or export-controlled technical data shall be used by the receiving Party or related entities only for the purposes of fulfilling the receiving Party's or related entity's responsibilities under this Agreement, and that the identified goods and marked proprietary technical data or marked export-controlled technical data shall not be disclosed or retransferred to any other entity without the prior written permission of

the furnishing Party or its related entity. The receiving Party or related entity shall abide by the terms of the notice and protect any such identified goods and marked proprietary technical data or marked export-controlled technical data from unauthorized use and disclosure. The Parties to this Agreement shall cause their related entities to be bound by the provisions of this Article related to use, disclosure, and retransfer of goods and marked technical data through contractual mechanisms or equivalent measures.

4. All goods exchanged in the performance of this Agreement shall be used by the receiving Party or related entity exclusively for the purposes of the Agreement. Upon completion of the activities under the Agreement, the receiving Party or related entity shall return or, at the request of the furnishing Party or its related entity, otherwise dispose of all goods and marked proprietary technical data or marked export-controlled technical data provided under this Agreement, as directed by the furnishing Party or related entity.

Article 8 - Intellectual Property

1. For the purposes of this Article, "Related Entity" includes but is not limited to contractors, subcontractors, grantees, or cooperating entities (or any lower tier contractor, subcontractor, grantee, or cooperating entities) of a Party.

2. Each party owns the data produced by its part of the study. However, it is understood that in order to reach the objective of the study, the data of both Parties must be merged.

3. Patents

(a) Nothing in this Agreement will be construed as granting, either expressly or by implication, to the other Party any rights to, or interest in, any inventions of a Party or its Related Entities made prior to the entry into force of, or outside the scope of, this Agreement, including any patents or other forms of protection (in any country) corresponding to such inventions.

(b) Any rights to, or interest in, any invention made in the performance of this Agreement solely by one Party or any of its Related Entities, including any patents or other forms of protection (in any country) corresponding to such invention, will be owned by such Party or, subject to paragraph 3(d) of this section, such Related Entity.

(c) It is not anticipated that there will be any joint inventions made in the performance of this Agreement. Nevertheless, in the event that an invention is jointly made by the Parties in the performance of this Agreement, the Parties will, in good faith. consult and agree as to: a) the allocation of rights to, or interest in, such joint invention, including any patents or other forms of protection (in any country) corresponding to such joint invention; b) the responsibilities, costs, and actions to be taken to establish and maintain patents or other forms of protection (in any country) for each such joint invention; and c) the terms and conditions of any license or other rights to be exchanged between the Parties or granted by one Party to the other Party.

(d) With respect to any invention created in the performance of this Agreement and involving a Related Entity, allocation of rights between a Party and its Related Entity to such invention, including any patents or other forms of protection (in any country) corresponding to such invention, will be determined by such Party's laws, regulations, and applicable contractual obligations.

4. Copyrights

(a) Nothing in this Agreement will be construed as granting, either expressly or by implication, to the other Party any rights to, or interest in, any copyrights of a Party or its Related Entities created prior to the entry into force of, or outside the scope of, this Agreement.

(b) Any copyrights in works created solely by one Party or any of its Related Entities, as a result of activities undertaken in performance of this Agreement, will be owned by such Party or Related Entity. Allocation of rights between such Party and its Related Entities to

such copyrights will be determined by such Party's laws, regulations, and applicable contractual obligations.

(c) For any jointly authored work, should the Parties decide to register the copyright in such work, they will, in good faith, consult and agree as to the responsibilities, costs, and actions to be taken to register copyrights and maintain copyright protection (in any country).

(d) Subject to the provisions of the Transfer of Goods and Technical Data section and the Publication of Public Information and Results section of this Agreement, each Party will have an irrevocable, royalty free right to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, and authorize others to do so on its behalf, any copyrighted work resulting from activities undertaken in the performance of this Agreement for its own purposes, regardless of whether the work was created solely by, or on behalf of, that Party or jointly with the other Party, and without consulting with or accounting to the other Party.

Article 9 - Rights in Resulting Data

The Parties shall analyze the raw data as specified in the EMPs and shall maintain regular communication during this process. Within six (6) months after recovery of the spacecraft, each Party shall provide the other with a preliminary Science Report for each experiment. The Parties shall exchange comments on each other's Science Report and shall resolve any issues within three (3) months. Neither Party may publish the data prior to resolution of all scientific issues. Notwithstanding this restriction, both Parties may publish the data (12) months after recovery of the spacecraft in the event that agreement is not reached on all issues.

The first publications in the U.S. and Russia for each experiment containing experimental data shall be Joint U.S./Russian publications. When published in Russia, the first author shall be the Russian Investigator. When published in the U.S., the first author shall be the U.S. Investigator. Subsequent publications may be joint or separate.

Regardless of the country in which the data are published, the source of the data shall be acknowledged in the publication with the following legend:

"Mission Data contained herein has been developed through joint cooperation between the U.S. and Russia in the Foton-M3 research satellite mission."

Article 10 - Customs, Taxes, and Immigration

In accordance with its laws and regulations, each Party shall facilitate free customs clearance and waiver of all applicable customs duties and taxes for equipment and related goods necessary for the implementation of this Agreement. The Parties' obligation to ensure duty-free entry and exit of equipment and related goods is fully reciprocal. For the purpose of transfers of goods between the United States and Russia, the *Agreement Between the Governments of the United States of America and the Russian Federation Concerning the Procedure for the Customs Documentation and Duty-Free Entry of Goods Transported Within the Framework ofU.S.-Russian Cooperation in the Exploration and Use of Space for Peaceful Purposes*, of December 16, 1994, and renewed on May 23, 2002, shall apply.

Article 11 - Ownership of Equipment

1. Equipment provided by NASA pursuant to this Agreement shall remain the property of NASA.

2. NASA shall bring certain equipment into Russia on a temporary basis for Principle Investigator use (hereinafter referred to as "Temporary Items") that shall be returned to the U.S. at the completion of the experimental activities. These Temporary Items shall be attached to this Agreement as Attachment 6.

3. Equipment provided by IMBP pursuant to this Agreement shall remain the property of

IMBP.

Article 12 - Mishap Investigation

In the case of a mishap or mission failure, the Parties agree to provide assistance to each other in the conduct of any investigation. In the case of activities, which rnighj result in the death of or serious injury to persons, or substantial loss of, or damage to properly as a result of activities under this Agreement, the Parties agree to establish a process for investigating each such mishap as part of their program/project implementation agreements.

Article 13-Consultation and Dispute Resolution

The Parties may consult on any matter arising out of this Agreement. An issue concerning the interpretation or implementation of the terms of this Agreement shall first be referred to the appropriate points of contact named above for the Parties. If they are unable to come to agreement on any issue, the dispute shall be referred to the Agreement signatories or their designated representatives for resolution.

Article 14 - Entry Into Force, Terms, Amendment and Termination

This Agreement shall enter into force on the date of the last signature. This Agreement shall remain in force for a period of five (5) years.

This Agreement may be amended at any time by mutual written agreement of the Parties. Articles 2 and 3 and attachments to this Agreement may be amended at any time by mutual written agreement of the IMBP Program Management Point of Contact and the NASA Technical Point of Contact established in this Agreement. Any amendment to the Attachments shall be subject to and consistent with this Agreement. In the event of a conflict between this Agreement and the Attachments, this Agreement shall take precedence.

A Party may terminate the agreement after sixty (60) days notification to the other Party. Termination or expiration of this Agreement shall not affect a Party's continuing obligations under the provisions on "Cross Waiver of Liability"; "Transfer of Data and Goods"; "Invention and Patent Rights"; "Rights in Resulting Data"; and "Customs, Taxes and Immigration."

This Agreement has been prepared in the English and Russian languages with both versions being equally authentic.

Gilbert R. Kirkham
Acting Director
Explorations Systems
and Aeronautics Division
Office of External Relations of
NASA

Anatoliy Grigoriev
Director
Russian Federation State
Research Center - Institute
Biomedical Problems

_____ _____

Date Date

Concurrence on Foton-M3 Agreement:

_____ _____

Mr. Michael G. Skidmore
NASA Foton-M3 Project Manager
NASA Ames Research Center

Date

_____ _____

XXXXXXXXXXXXxx
XXXXXXXXXXXXXX
Advanced Capabilities
Exploration Systems Mission Directorate
NASA Headquarters

Data

Carl Walz — Date
Special Assistant, Advanced Capabilities
Exploration Systems Mission Directorate
NASA Headquarters

John Hall — Date
Director, Export Control and Interagency Liaison
Office of External Relations
NASA Headquarters

General Counsel — Date
NASA Headquarters

bcc:
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OER/Bill Barry
/Deirdre Healey
/Stephen Ballard

Prep: M. Skidmore 5-15-06; rev SBallard 5/18/06; rev RFrank 6/12/06; rev SBallard 6/14/06

File: Russia Cooperation; ESAR Chron; ESAR Reading; SEB Chron