

Managerial issues in organizing large-scale analog projects with wide international participation

Oleg I. Orlov, Anna R. Kussmaul*, Mark S. Belakovskiy, Tatiana N. Agaptseva

^a *Institute of Biomedical Problems of the Russian Academy of Sciences (IBMP RAS), 76A Khoroshevskoye shosse, Moscow, Russia 123007, annakusmaul@gmail.com*

* Corresponding Author

Abstract

In the modern world with globalized technology and standardized procedures and research, it is very difficult to advance the technological and scientific progress alone. Institute of Biomedical Problems (IBMP) is trying to involve the leading space agencies, scientific institutions and other organizations from around the globe in its projects to coordinate efforts. When such projects involving a large number of research groups from different countries are organized, a number of problems will inevitably occur. Effective roadmaps and routes of cooperation are being developed by IBMP that allow prompt notification and joint solution of emerging problems. It leads to the mutual benefit of the parties and makes it possible to increase the effectiveness of ongoing activities and research. Such cooperation will make it possible to ensure human life in long-range space missions and support the widespread commercialization of space technologies.

Keywords: space biology and medicine, unique scientific facilities, analog experiments, space flight simulation, international cooperation

1. Introduction

International cooperation is a prerequisite to a successful large-scale biomedical project both in space and on Earth. In the modern world with globalized technology and standardized procedures and research, it is very difficult to advance the technological and scientific progress alone. Understanding that, the Institute of Biomedical Problems (IBMP) is trying to involve the leading space agencies, scientific institutions and other organizations from around the globe in its projects that simulate certain space flight factors. [1, 2]

2. Analog studies

Analog experiments provide opportunities not only for studying the effects of space flight factors on the body, but also for developing technologies for use on board of spacecrafts and space and planetary stations. They also allow to bench-test both scientific and medical equipment, including simultaneous use, to evaluate the ergonomics of spacecraft cabins, and to work out cooperation between various organizations that contribute to a project. Yet conducting such experiments is quite resource-intensive, and international cooperation consolidates those resources and thus increases the efficiency of the projects.

Conventionally, analog experiments can be divided into 2 groups: those where isolation, artificial monotonous environment and crowding act as the leading factor (for example, research in hermetic chambers and in naturally isolated conditions like Arctic stations), and studies that simulate microgravity (for example, anti-orthostatic studies and immersion). The IBMP has been conducting the experiments of both types since the 1960s. To do this, the Institute has developed the Unique Scientific Facilities which allow to study both the effects of prolonged isolation (the Ground-Based Experimental Facility) and the effects of the weightlessness factor on the human body (the Dry Immersion stand and the Hypogravity stand), as well as to test various models of countering the negative effects of space flights, for example, using the Short-Arm Centrifuge (SAC).



Fig. 1. Unique Scientific Facilities of IBMP.

For many years the IBMP has been successfully implementing international analog projects involving space agencies and space research institutions from the USA, France, Germany, Japan, Italy, Canada and a number of other countries. [3, 4, 5].



Fig. 2. IBMP international projects.

Currently, the list of countries participating in human space programs is expanding. Thus, the Institute started an active cooperation with the Mohammed Bin Rashid Space Center from the United Arab Emirates, and there is a hope that other countries of the Middle East region will also show interest in the IBMP projects.

3. Problems of international projects and ways to solve them

When a large-scale international project involving a large number of research groups from different countries (and sometimes different parts of the world) is organized, a number of problems will inevitably occur. [6]. These include:

3.1 Insufficient data to make reasonable predictions about the applicability of a particular project

In order for as many interested teams/organizations as possible to participate in a particular project, the information about it should be given in advance, with a detailed description of the conditions and benefits that the participation in the project gives, as well as possible limitations. The IBMP uses various platforms to announce its projects, including congresses and conferences. However, foreign partners, especially those who are not familiar with the activities of the Institute, do not always have the opportunity to quickly get the full information about a promising project, because most of the information is given in the Russian mass media, as well as on the Institute's website and social media. The solution could be the timely announcement of the project to the established foreign partners and their assistance in promoting the upcoming works.

3.2 Too long (or indefinite) time from the start of a project to the final result and, as a consequence, higher risk of the projects.

For example, the isolation projects are designed for a long time, from several weeks to several months, sometimes years. It is not always possible to have financing for a project for several years ahead. One of the solutions to this may be a breakdown into stages or providing the ability to quit the project.

3.3 The confidentiality of scientific and commercial user information during the preparation and conduct of an international project.

In order to protect such information, cooperation agreements must include confidentiality clauses, and/or separate non-disclosure agreements are required.

3.4 Legal issues, including the protection of intellectual property rights, data exchange liability and many others.

One of the important tasks is personal data protection. In its projects, the IBMP ensures compliance with international legislation through signing appropriate informed consents, assigning identification numbers or codes to the test subjects. The intellectual property issues are discussed in advance with all participants and are reflected in contracts/agreements.

3.5 High costs and determining the balance of contributions of the parties.

Clearly, the biggest costs are borne by the party that is organizing the project and provides the equipment and human resources for its implementation. But each new participant enters the project with its own goals and funding. Determining the balance of contributions is not an easy task, which is solved individually in each case by confirming a scientific protocol, payment schedules and the amount of data transmitted.

3.6 The established organizational approaches and work procedures adopted in a particular country.

When working with foreign partners, it is advisable to take into account the specifics of the bureaucratic system in different countries, the time required for decision-making, the beginning of the fiscal year and, accordingly, the deadlines for submitting an application for participation, as well as the requirements for signing contract documents.

3.7 Export/import of equipment and materials.

This problem becomes especially relevant when logistical and diplomatic ties are disrupted and there is a need to obtain permission documents. All export/import requirements and restrictions must be communicated to foreign partners in advance and with alternative ways like renting equipment in Moscow or using diplomatic channels to supply scientific equipment. The problem of exporting collected biomaterials is becoming especially urgent now. The simplest solution would be to study the collected samples in the laboratories of IBMP or other Russian organizations by specialists from other countries. The Institute has a similar experience in organizing such activities, for example, in the BION-M1 project, when US researchers worked on the premises of the Institute.

3.8 The difference in the mentalities of participants.

When performing projects with the participation of volunteers from different countries / parts of the world, it is necessary to consider the fact that they will have different approaches to food, hygiene procedures, spending free time, rules of conduct and principles of communication. They may need time to perform religious rites, misunderstandings may arise due to incorrect interpretation of behavior. All above and other issues related to the difference in mentalities should be solved in advance with the involvement of a wide range of specialists.

The solution of all emerging problems requires the involvement of additional personnel for the effective management of such projects. At the same time, responsible persons are appointed both for the scientific part of the interaction, and for the financial and economic, customs, intellectual and legal issues, etc. Effective roadmaps and routes of cooperation are being developed that allow prompt notification and joint solution of emerging problems.

4. Advantages of cooperative studies

Nevertheless, the involvement of foreign organizations in the projects and the implementation of joint research programs allow to:

- substantially expand the range of possible participants, implement the methods and use the equipment that are not used by the Russian researchers. For example, various isolation experiments used the devices provided by foreign partners to study sleep, bone metabolism, gastrointestinal tract, etc.;
- maintain working contacts with foreign research centers and be in the know of modern research methods in certain scientific areas. Thus, during the joint experiments, close contacts were established between the research groups working in various areas of space medicine, which made it possible to further organize expanded research and receive international grants for joint projects;
- take advantage of the material resources of foreign scientific institutions or individual performers. Thus, the metabolomic and biochemical processing of the biomaterials obtained in analog experiments were often carried out in specialized laboratories of foreign partners.

5. Conclusions

The coordinated effort leads not only to the mutual benefit of the parties (accumulated knowledge, practical experience, technical, financial and methodological capabilities of the parties), but also makes it possible to avoid unnecessary duplication of similar procedures, optimize the cyclogram of the crew activities, increase the effectiveness of ongoing activities and research. It is obvious that such cooperation will make it possible to ensure human life in long-range space missions and support the widespread commercialization of space technologies.

References

- [1] M.S. Belakovskiy, Experience in organizing international cooperation in the field of space medicine and biology on a commercial basis, Practice of international business. 2 (8). (2003) 13-17. In Russian.
- [2] A.R. Kussmaul, International cooperation in isolation studies, Information Technology Bulletin, 2 (24) (2020) 26-35. In Russian.
- [3] M.S. Belakovskiy, E.P. Demin, Experiments HUBES, ECOPSY-95 and SFINCSS-99, in Space medicine and biology: Collection of scientific articles, ed. A.I. Grigorieva, I.B. Ushakov, Publishing and Printing Center "Scientific Book", Voronezh, 2013, pp. 499-507. In Russian.
- [4] V.I. Gushchin, K. Binsted, E.P. Demin, D.V. Komissarova, M.S. Belakovskiy, Experience and prospects of model isolation experiments in Russia and the USA, Aerospace and Ecological Medicine. 50 (5) (2016) 61-63. In Russian.
- [5] B.V. Morukov, M.S. Belakovskiy, E.P. Demin, Experiment with a 520-day stay of the crew in isolation (Project "Mars-500"), in Space medicine and biology: Collection of scientific articles, ed. A.I. Grigorieva, I.B. Ushakov, Publishing and Printing Center "Scientific Book", Voronezh, 2013, pp. 508-516. In Russian.
- [6] Model experiment with long-term isolation: problems and achievements, ed. V.M. Baranov, Firm "Slovo", Moscow, 2001, 590 p. In Russian.