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**KEY PROBLEMS OF RUSSIAN  
SPACE INDUSTRY INTEGRATION  
INTO INTERNATIONAL SPACE  
MARKET**

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## SOME KEY PROBLEMS OF RUSSIAN SPACE INDUSTRY INTEGRATION INTO INTERNATIONAL SPACE MARKET

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### Abstract

In the paper the state-of-the-art of the Russian space industry economy, including the International Space Activity (ISA), has been observed. Based on this data one could conclude that ISA becomes one of the key factors of the Russian space industry viability. From such point of view, it is obvious that Russia is interested in further integration into the international space market. On the other hand, the international space community demonstrates a steadily growing interest to the Russian space industry resources, know-how and its possible applications.

Based on experience of the ISA in Russia, key problems of the Russian space industry integration into the international space market are identified as problems of harmonization according to international principles and standards in the following areas:

- general management;
- space program and project management;
- economics;
- legislation.

General trends and examples of the problems solving in these areas, aiming at integration of the Russian space industry into the international space activity, are presented.

### Introduction

Today, one can say that the strategic situation have been essentially changed in the global space activities, and a new phase of the space activity development can be characterized with both high rates of commercialization and expansion of international co-operation. Nowadays, the development of astronautics as a whole, and also of particular space programs and projects, is under a dominant influence of economical factors [1].

The current changes have been taking into account by national space agencies at their development of new strategic plans [15], aimed at correction of a government role in the space activity support, and also at establishment of new partner relations between the agencies and industry. Under such conditions, the budgets for space programs have been undergoing a phase of their freezing or even reduction. On the other hand, there are large-scale and long-term space programs and projects which require significant investments and also joining of other resources of the international community both in terms of joint activity and in commercial terms (see Fig.1).

More than 120 countries have been engaged in the space activity for the last years. The impact of the astronautics has been growing and expanding as it plays a part of a catalyst and locomotive for our civilization economic progress, and a tool to solve the global

problems of mankind in the field of energy, resources, ecology, safety, telecommunications, information technology space infrastructure, new materials manufacture under microgravity conditions (*see* Fig.2).

Under the new tendencies development in the global astronautics, the problem of participation of Russia, one of the leading space powers, in the realization of the most important international programs and projects cannot be ignored. However, a prolonged decision of home problems in the Russian economy (that makes the world community worry) makes an analysis of the Russian astronautics prospects urgent, particularly with regard to her international obligations fulfillment and also of her plans and activities aimed at her further integration in the international community in the area of space activities.

#### **Current Economic Status and Role of International Cooperation for the Russian Space Industry**

After the USSR disintegration, in Russia there are more than 80 % of the space scientific and technical potential of the former Soviet Union [13]. So, it is quite obvious that the Russian experience and know-how, ones of the largest in the world, attract foreign partners to joint activity, strategic partnership and collaboration on a commercial basis. A list of the main Russian space technologies, attracting foreign partners, is represented in Table 1.

The current joint scientific and technical projects with participation of Russia are estimated at more than \$1.0 Billion. Some of those large -scale projects are shown in Figure 3. However, nowadays the share of Russia in the global space market amounts 2-3 % only of the total global commercial space activity revenue mentioned in [2] while the Russian industrial potential\* is estimated as 50 % of the global level [9].

(\*) – industrial potential is understood as an aggregate of worldwide technical systems and equipment used for space exploration and utilization which can be produced and placed in operation by means of the global space industry within a one-year term.

**Table 1**

#### **Priority Directions of the Russian Space Industry**

1. Space transportation systems (services & technology)
2. Spacecraft and space platforms
3. Long-term manned space flights
4. Liquid-propellant rocket engines
5. Electric thrusters
6. Onboard nuclear power stations
7. Life support system
8. Space biology and medicine
9. Space materials technology
10. Manufacture in microgravity conditions
11. Hydrogenous technologies
12. Hypersonic technologies
13. Earth observation systems
14. Infrastructure of ground test & research facilities
15. Onboard guidance & control systems
16. Global positioning & navigation systems
17. High resolution Earth imaging systems
18. Heat insulation and structural materials

The problem of the disproportion, existing between the space potential of Russia and her real participation in the national and global space activity, must be urgently solved in view of a difficult situation in the national economy of Russia (*see* Fig.4). Delays under the International Space Station program by Russia, and also an insufficient status of the Russian satellite fleet are good examples for demonstration the consequences of such situation (*see* Fig.5).

Application of Russian space technologies and services in the international activity is an evident way to constrain the Russian industry

stagnation. A comparison of the data on the Russian space industry budget with estimations of the income from commercialization of space activity [13] shows that the commercial income exceeds the state budget in 1997 (\$750.0 M and \$650.0 M respectively). It confirms an important role of the international cooperation in saving of the main directions of the space astronautics.

In case the positive tendencies, stirring up the Russian space industry activity, are kept alive, the RKA predicts an increase of the annual income in the Russian space industry up to \$3,0 Billion during the next several years on the basis of the fifty-fifty government budget-to-commercial contracts ratio [13].

It is very important to emphasize that an essential share of international projects with participation of Russia is aimed at innovations, and both Russian and foreign partners are interested in it. For instance, the *NPO PM/Alcatel* partnership developed the «Express A», new generation communication satellites to replace the satellites of the Russian national «Gorizont» constellation. The facts evidently demonstrate that the international co-operation serves as a good support for saving the main directions of the Russian astronautics and also it stimulates their development through innovation.

### **Russian International Space Activity Lessons Learned**

It should be noticed that Russian and many (we hope - most) foreign experts [3, 6, 7, 8] do not consider the state of the Russian astronautics as a question of Russia survival in the global market or her elimination (as a competitor) out of it. First of all, the problem is to save the great technology potential accumulated in Russia and soviet space astronautics for the mankind. Undoubtedly, destruction and loss of the experience gained will have an impact on the

common development of global astronautics, and if taking into account the global strategic role of the astronautics, will also restrain the development and solution of the key problems of our civilization.

Thus, in the long-term future the process of integration of the Russian astronautics in the global space activity as a part of the general process of Russia integration in the global economic and political system, is seemed to be objectively necessary and positive for the global community. Rates and results of the process depend essentially on both a proper understanding and the ways to overcome the problems, interfering the integration.

The main reasons, constraining the Russian space industry integration in the international space activity, including commercial, have been analyzed in a series of works [6-8, 11].

Results of the data generalization validated with experience, show that a language barrier and difference in technical or technology aspects of the space activity development in Russia and abroad are not the main obstacles on the way to the Russian astronautics integration into the global space activity.

Russian and foreign experts assume that the more serious problem is harmonization of the Russian astronautics with international, economic and legal principles and standards which is required in the following directions:

- general management;
- space program and project management;
- economics;
- legislation aspects of international co-operation.

Undoubtedly, the above problem is not particular for one industry, but a common problem of the Russian economy in the unusual and new conditions of market environment. Therefore, a successful solution of the problem is achievable in the plane of the government decisions and coordinated government policy.

In this connection, in opinion of the authors, the existing, quite high level of centralization of the all space activities in Russia, including foreign business, is not a disadvantage (as it is frequently noticed by some foreign partners of Russia), but on the contrary, an important precondition for the most fast and successful co-ordination of activities to solve the said problems of harmonization in the Russian space industry.

The period after 1991 when the enterprises of the Russian space industry started their independent entrance on the world space activity market may be characterized as a period of tests and errors in the realization of foreign trade activities. In opinion of the authors, a part of the international co-operation activities was unprofitable for Russia, directly or indirectly.

In a direct form, it was caused by the lack of a toolkit for proper preparation and then realization of contract terms, calculation of a contract price with proper account of the effect of inflation, identification of the intellectual property subjects and also their cost estimation, account in the price the factors influencing the amortization of manpower and technical resources.

A number of first contracts in the field of launch services with Russian launchers and also participation in some large-scale projects were, as it is well-known, unprofitable for Russia.

In an indirect form, the unprofitability of foreign business activities is frequently connected with the loss of competitive advantages due to a priority technology transfer with no proper cost account in a contract price or technology leakage caused by defects in data security systems which have been undergoing their development phase. The loss of competitive advantages can finally lead to the development of business with no prospects and its cancellation.

Advantages of international cooperation for the Russian space industry are still under discussion in Russian mass media with regard to some of the technologies listed in fig. 3. Participants and results of international activity in the areas are well known.

### **New Trends and Examples of Russian Space Industry Harmonization with International Practice**

At present, in the Russian astronautics the period of fragmentary accumulation of international co-operation experience has been ending, and a period of system changes has been starting in the area of international co-operation organization as a component of the common process of formation of a new mechanism for the Russian space industry operation in conditions of the market economy.

The main change trends in Russia are listed below which also correlate with the current observable changes in the policy of many foreign space agencies.

The essence of such changes consists in recognition of the commercialization as the second (after the government program) dominant factor which affects the further development of space activity, and also in understanding of the need in a package of actions to create an advanced business environment in the space industry and to provide it with the government support.

In that connection, the current objectives of the Russian space industry are as follows:

- concentrated and controllable space industry which covers all priority directions of space activity;
- government budgeting sufficient to provide at least a financial support of space fundamental and applied scientific research.



ground facility operation and launch site operation;

- extra-government budget formation due to diverse sources, including commercialization of the space activity at national and international levels;
- selective support of strategic partnership and joint venture with foreign partners;

Among the important changes in organization of space activity in Russia there are as follows:

*I. Re-structuring of the space industry by both concentration and decentralization of space companies, and also reengineering inside some of the companies as well.*

Since May, 1998, after a big amount of enterprises were transferred under the RKA jurisdiction, their total number increased up to 100, including the overwhelming majority of the leading Russian space research centers, design bureaus, production enterprises.

The undertaken concentration of space enterprises under the RKA jurisdiction creates the base precondition for a successful realization of the «Program on re-structuring of the space and rocket industry and activities for saving its scientific, technical and industrial potential up to 2000», approved by the Decree of the Government of Russian Federation in the mid 1998.

The goal of the Program is stabilization of the space industry economic with an optimum saving of the existing research and production potential in all priority directions:

- Satellite Fleet
- Telecommunication and Broadcasting
- Navigation
- Earth Observation
- Manned Space Flights
- Space Transportation Systems (expandable and reusable)
- Ground Facilities and Launch Sites
- Space Exploration

#### • Fundamental and Applied Space Technology Research

As a result of the Program fulfillment, a part of the concentrated space industry «backbone» is supposed to be saved with a guaranteed government financial support. It is also supposed that the other part of the industry potential focused on commercial and venture directions can be decentralized into joint-stock companies, affiliated firms and other legal forms of enterprises with a possibility of their activity control by the RKA or mother companies.

The well known recent examples of space industry concentration are as follows: foundation of Khrunichev State Space Scientific Research and Production Center (1993, Moscow) and TsSKB-Progress State Space and Rocket Center (1996, Samara) and some others.

At the same time, tens of daughter companies (formed during the last years) have been licensed by RKA for business development in commercial venture projects. For instance, the GEO-TSUP company, an affiliate of Mission Control Center, is among them. The company recruits international teams for research and development of GLONASS (Russia) and GPS (USA) compatible systems. AO GAZKOM which deals with development of *Yamal*, a new generation satellite based on the advanced world technology, *Tsnnimash-Export* company which conducts development work in the area of advanced space technologies and also corporate management systems integration, and many other venture companies could be mentioned among them.

Nowadays, there are good opportunities for foundation of strategic partnerships between Russian and foreign space companies in such commercial areas as space services, joint technology developments, etc.

## *II. Correction of priority changes in the budgeting policy.*

Concentration of the government financing for fundamental research programs and a shift of some part of financial weight for advanced commercial applied projects on the shoulders of re-structured government, joint-stock and affiliated companies, having a good outlook for their commercialization. The budget is supposed to be actively used as a catalyst of the projects planned for commercialization.

E.g., in 1998, for the first time, the RKA has arranged a tender on the development of new satellites to replace the *Gorizont* constellation. As a result, *Yamal* of RSC *Energial GASKOM* JSC and *Express A* commercial satellites of NPO PM/Alcatel won the tender and get an opportunity for development of a commercial satellite telecommunication system which deployment shall be backed with the RKA budget under several terms.

## *III. Interaction of the RKA with the Ministry of Defense within the framework of double application technology programs.*

This direction along with the creation of a program on space technologies conversion and transfer into diverse sectors of national economy are the priority directions of the Russian space activity in fulfillment of the above mentioned «Program on Re-structuring of the Space and Rocket Industry and Activities for Saving its Scientific, Technical and Industrial Potential up to 2000».

Within the last two years under a direct support of the RKA there have been established a *Technology Transfer Center* (Moscow) aimed at creation of a technology transfer national network system based on advanced global experience in this area. GAZPROM, Russian Central Bank, Ministry of Healthcare and many others are the main customers in the technology transfer in the Russian Space Industry.

## *IV. Implementation of advanced economic management technologies for the space enterprises, harmonized with the international principles and standards.*

This process is the key and most difficult change in the Russian Space Industry re-structuring trends [8, 10].

The process evolution in the Russian space industry could be split in 2 phases:

➤ Phase 1 - Recognition of the fact that in management, economics and legislation there is a need in harmonization [12]; development and implementation of some business technologies on the basis of local intranet systems (planning, accounting, market analysis, cost analysis, project and human resources management, etc.)

For instant, a cost accounting system for the space industry, harmonized with the international cost accounting standards (IAS) was implemented in *TSNIIMASH-Export* under the RKA, European Commission, ESA and *Deloitte & Touché* support [8]. The work was conducted within the framework of the ESA and RKA interaction initiative. The related Decree of the RF Government in 1997 became a good stimulus for successful activities in the direction.

The goal of activities is getting over the barriers on the way of equal-in-rights participation of Russian space companies in international tenders, joint projects and joint companies, formation of a good investment and credit climate in the Russian space industry. Nowadays, a number of leading Russian space enterprises work in this direction.

➤ Phase 2 - Search for solutions to provide a radical enhancement of the corporate manageability. An effective management is really the key tool to provide a company survivability on the basis of both internal capabilities (proper utilization of internal resources, strong discipline, order, etc.) and also

external factors (involving of non-state funds at the domestic and international space activity markets, foundation of new strategic partnerships to produce new competitive products.

Nowadays, many Russian space firms consider purchase and implementation of advanced management technology software, starting from small integrated systems which join the basic administration departments in a common corporate intranet and up to such powerful integrated management systems as R/3 or BAAN.

Leading enterprises of the national space industry (Khrunichev GKNPTs, RKK Energiya, NPO PM and others) have already gained experience in the implementation of new management technologies for strategic planning, cost accounting, marketing, business planning, space project management, parametric cost assessment modeling of space technology R&D activities. On the opinion of directors of the said firms [14], the experience shows that the implementation of such systems is highly efficient.

Russian practice does not differ from foreign one very dramatically but needs to be harmonized in some areas such as space project management principles, application of the methods for cost estimations of the development and manufacture of space industry products on the basis of empirical parametric cost estimation models [4, 6]. At the same time, in the former Russian space industry actually there were no experience and knowledge in most other business technologies mentioned above. Implementation of the said technologies is an indispensable condition for national space functionability in the environment of market economy, and particular - during their integration into the international market of space activities.

### **Conclusion.**

Undoubtedly, the experience of Russian and international space industries gained in their interaction in the area of space exploration, space technology R&D work, joint business activities on the global market, opens a good outlook for further expansion of their cooperation to their mutual benefit.

On the basis of the analysis of changes occurring in Russian astronautics, one can make a conclusion about a strong tendency in the plans of national space companies to harmonize the areas of management, economy and business infrastructure organization according to international principles and standards. That is a key element of a radical enhancement of survivability and controllability of national space companies, and also their successful integration into the international space activity.

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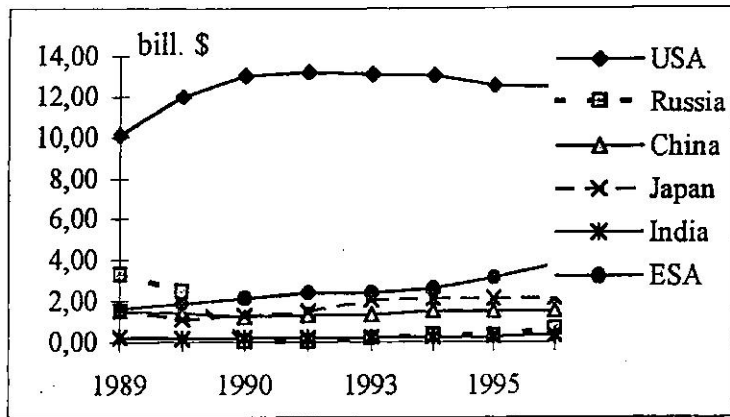
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### State Civil Space Budgets, bill. \$ (RKA's data base)



	1989	1990	1991	1992	1993	1994	1995	1996
USA	10,10	12,00	13,04	13,20	13,08	13,02	12,53	12,42
Russia	3,28	2,49	0,02	0,05	0,18	0,38	0,32	0,65
China	1,5	1,40	1,20	1,30	1,35	1,50	1,50	1,50
Japan	1,5	1,10	1,26	1,47	2,05	2,10	2,10	2,15
India	0,24	0,17	0,20	0,19	0,23	0,25	0,28	0,33
ESA	1,60	1,86	2,12	2,40	2,40	2,60	3,12	3,73

### Large Scale Projects, bill. \$

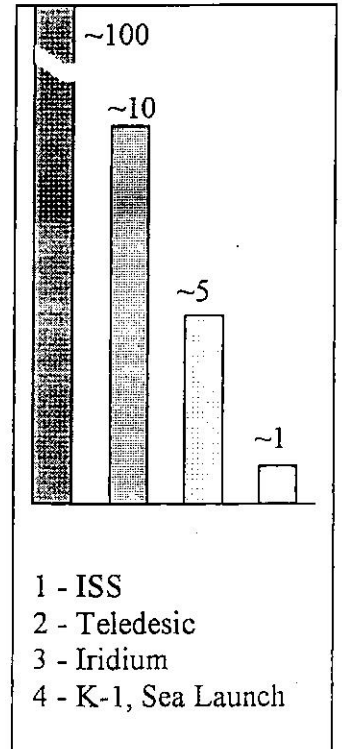
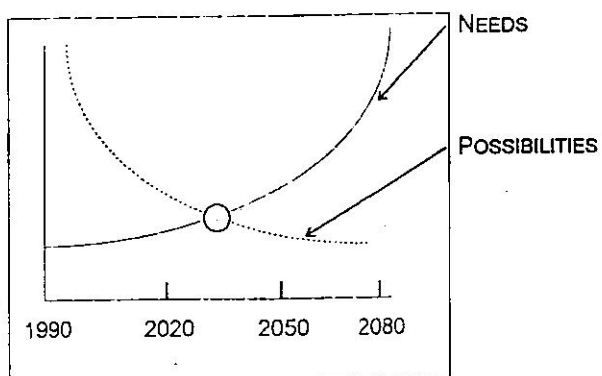


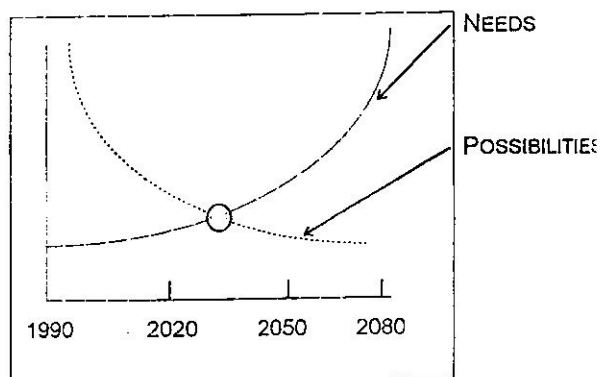
Figure 1.

## GLOBAL PROBLEMS OF MANKIND

EARTH RESOURCES OF POWER  
PER HEAD



EARTH RESOURCES OF RAW MATERIALS  
PER HEAD



- ENERGY CATASTROPHE
- DEPLETION OF RESOURCES
- ECOLOGY CATASTROPHE
  - warming of the globe climate caused by hotbed effect
  - ozone depletion (expansion of the hole in the ozone layer)
  - atmosphere contamination with nuclear & chemical wastes

Figure 2.

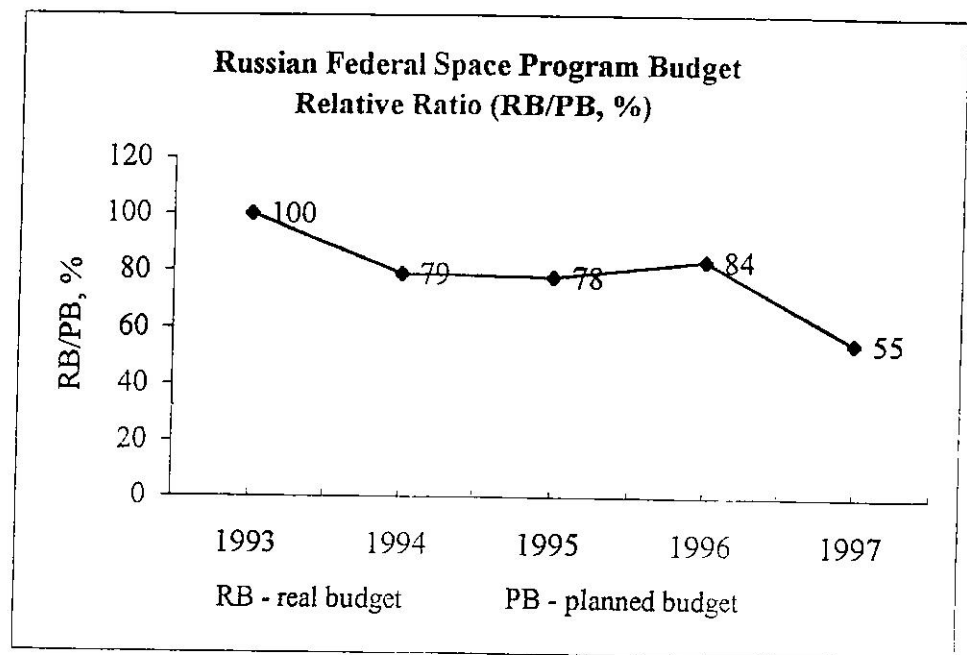
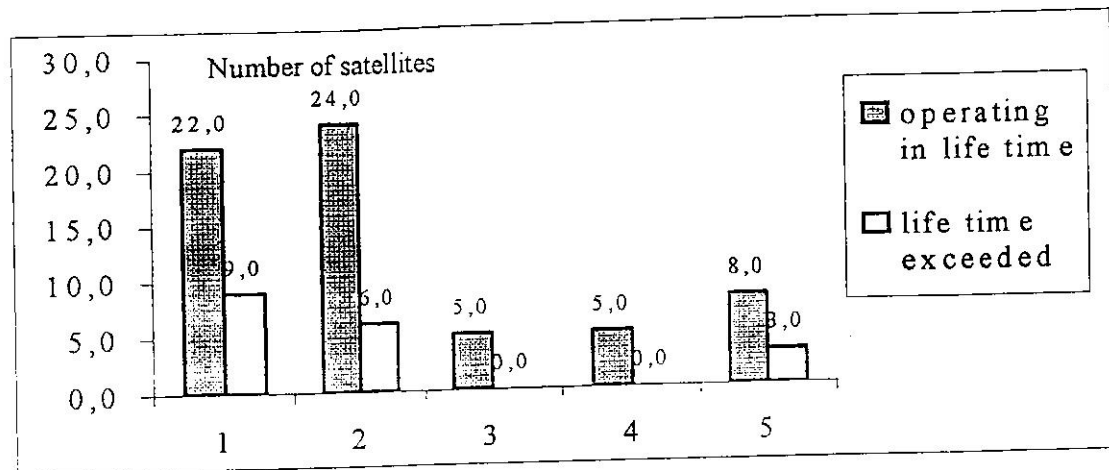


Figure 4.

## CURRENT STATUS OF RUSSIAN CIVIL SATELLITE CONSTELLATIONS



- 1 - Telecommunication
- 2 - Navigation
- 3 - Earth remote sensing
- 4 - Science
- 5 - Manned

Figure 5