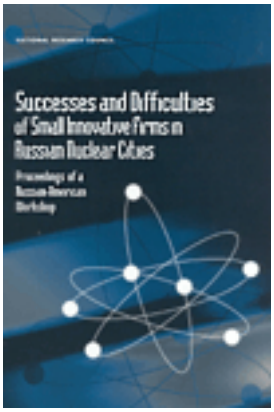

Successes and Difficulties of Small Innovative Firms in Russian Nuclear Cities: Proceedings of a Russian-American Workshop

Committee on Small Innovative Firms in Russian Nuclear Cities, Office for Central Europe and Eurasia Development, Security, and Cooperation, National Research Council, In cooperation with the Institute of Physics and Power Engineering, Obninsk, Russia

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Office for Central Europe and Eurasia
Development, Security, and Cooperation
Policy and Global Affairs
National Research Council

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Preface

In October 2000 the Department of Energy (DOE), the Russian Ministry of Atomic Energy (Minatom), and the National Research Council (NRC) agreed that a workshop on the successes and difficulties of small innovative firms in several of the atomic cities of Russia would be helpful in identifying business approaches and Russian governmental policies that should be encouraged through joint programs of the U.S. and Russian governments and through the efforts of Western nongovernmental organizations. The Nuclear Cities Initiative of DOE awarded a contract to the NRC to assume responsibility for organizing the workshop. Having previously conducted projects in Russia on commercialization of technology, the NRC was in a good position to design a workshop that would be relevant to the needs of both the Russian and the U.S. governments. Minatom selected the Institute for Physics and Power Engineering (IPPE) in Obninsk as the Russian counterpart to work with the NRC in organizing the workshop and to serve as the host for the workshop. IPPE has had extensive experience in organizing international conferences on topics related to technology commercialization.

A workshop was held in Obninsk in September 2001. Twenty Russian specialists from five nuclear cities and Moscow, seven American specialists, and representatives of DOE and the technical assistance program of the European Union (Tacis) made presentations. An additional 20 Russian specialists attended the workshop and made useful comments on the presentations. The presentations addressed many aspects of the establishment and management of small innovative firms in Russia, including a

number of specific examples of the activities of small firms, as well as lessons learned in establishing commercially viable firms in the United States. While there are great differences in the business environments, in the training and experience of entrepreneurs, in the communication and physical infrastructures, and in the availability of financial resources in the two countries, some principles concerning management, marketing, and general business strategies are relevant in both countries. This report includes the presentations made at the workshop, with many of them reflecting general principles that enhance the likelihood of profitability of firms in both countries.

Prior to the workshop the American participants visited three small firms in Obninsk and several state research institutes that have had experience in encouraging the establishment of firms based in part on technical capabilities developed within the institutes. These visits helped orient the American specialists to the realities of doing business in Russia and highlighted various approaches that have been followed.

At the end of the first day of the workshop, the participants received the news of the terrorist attacks on New York and Washington.

Since the American participants would be unable to return to the United States for several days, they collectively proposed continuing the workshop and completing the planned program. Our Russian hosts agreed with this approach. So, despite the uncertainties concerning events in the United States, the workshop was completed as scheduled.

I would like to express my appreciation to the other members of the NRC committee who assisted in the preparations for the workshop and reviewed these proceedings. We are indebted to the Russian organizers of the workshop, particularly Alexander Sorokin and Valery Balanda, who assembled an excellent group of Russian participants and made all the arrangements for a successful workshop. Also, we commend William Desmond of DOE, who had the foresight to support this workshop and who assisted in navigating the bureaucratic hazards in Washington and Moscow that constantly threatened to result in its cancellation.

The Americans attending the workshop were deeply grateful to their Russian friends for the outpouring of sympathy and support they expressed to us regarding the terrible tragedy that befell the United States during our visit. None of us will ever forget what we were doing and whom we were with in Obninsk, Russia, on September 11, 2001.

ACKNOWLEDGMENTS

These proceedings have been reviewed in draft form by individuals chosen for their technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this

independent review is to provide candid and critical comments that will assist the institution in making its published proceedings as sound as possible and to ensure that the proceedings meet institutional standards for quality. The review comments and draft manuscript remain confidential. In addition to the members of the NRC Committee, I wish to thank Blaine Gibson, Siberia Pacific Company, for his review of selected papers in this proceedings.

We wish to thank Kelly Robbins for her translation of the Russian language papers into English. Special thanks also to Jan Dee Summers, Kelly Robbins, and A. Chelsea Sharber for their editing of the proceedings.

—Alvin Trivelpiece
Chair, NRC Committee on Small Innovative Firms
in Russian Nuclear Cities

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Nuclear Cities Initiative: Interests of the Program

George D. Pomeroy
Nuclear Cities Initiative
U.S. Department of Energy

It is my great pleasure to be here with you today in Obninsk. The Nuclear Cities Initiative (NCI) is proud to be the sponsor of this important workshop, which addresses the successes and challenges facing small innovative firms in Russian nuclear cities. Each of you has considerable experience to share, which can increase the effectiveness of defense conversion activities in the Russian nuclear weapons complex. As a group, there is even greater potential for insight through the synergy created through dialogue and exchange. During the next three days, I look forward to sharing with you lessons learned in the development of business opportunities in the five nuclear cities of Sarov, Zheleznogorsk, Snezhinsk, Obninsk, and Zarechny. I am especially interested in discussions on

- successes and failures in creating or expanding commercial businesses
- marketing strategies for domestic or foreign markets
- components that enable success and, on the other hand, obstacles to success
- sources of external financing
- other strategies for increasing the effectiveness of business development

I would like to take a few minutes to discuss the broad outlines of NCI and share with you some of our experience to date.

RUSSIAN NUCLEAR WEAPONS COMPLEX

The five nuclear cities we are addressing in this workshop are only a part of the Russian nuclear weapons complex. The Ministry of Atomic

Energy of the Russian Federation (Minatom) has expressed intent to downsize this large complex over the coming years. The reasons for this planned downsizing include the sharp reduction in warhead needs a decade after the end of the "cold war," the sharp corresponding downsizing of the U.S. nuclear weapons complex, the high cost of maintaining the Russian complex at its current size, and the world security interest in nonproliferation efforts.

The Russian nuclear weapons complex has the largest quantity of weapons-usable material in the world. It also has the largest concentration of weapons of mass destruction in the world. The nuclear cities as a group have more than 700,000 residents. Alternative employment will be needed for up to 40,000 workers over the near term, since they will no longer be needed to support the Russian defense mission.

There are 10 closed nuclear cities in the weapons complex, including the NCI pilot cities of Sarov, Zheleznogorsk, and Snezhinsk. A number of additional cities that have supported the weapons complex are open, including Obninsk, or semirestricted, including Zarechny. These cities have populations of up to 100,000. Sarov includes a weapons design institute, VNIIEF (the All-Russian Scientific-Research Institute of Experimental Physics); a weapons assembly/disassembly plant, Avangard; and plutonium storage facilities. Minatom has announced plans to end weapons assembly/disassembly activities at Avangard over the next few years. Zheleznogorsk is a plutonium production, reprocessing, and storage site, with one remaining reactor that serves to provide heat and electricity to the city. Minatom has plans to shut down the last reactor in a few years, once a replacement utility plant has been built to supply steam and electricity to the city. Snezhinsk is home to a weapons design institute, VNIITF (the All-Russian Scientific-Research Institute of Technical Physics), as well as plutonium and highly enriched uranium storage facilities, and may have a reduced defense mission compared with earlier years.

THE NCI PROGRAM

The Nuclear Cities Initiative is a nonproliferation program within the National Nuclear Security Administration of the U.S. Department of Energy. The purpose of NCI is to enhance U.S. and global security by supporting weapons complex reduction in Russian nuclear cities. NCI works in cooperation with Minatom to redirect functions and equipment in the weapons complex; reduce the physical footprint; and create sustainable, alternative nonweapons work within a functioning city economy.

Strategies to accomplish these goals include

- creating jointly developed city plans for accelerated downsizing of the Russian nuclear weapons complex

- creating infrastructure to support economic diversification and job creation in the cities
- facilitating a transition from weapons-related research to non-military funded business and commercial projects
- conducting targeted business training and exchanges to improve marketing and management of businesses and projects
- leveraging funding and encouraging outside investment

At present, these strategies are being implemented at the three NCI pilot cities—Sarov, Zheleznogorsk, and Snezhinsk. In the future, NCI may expand its nonproliferation activities to include additional nuclear cities, working jointly with Minatom on defense conversion implementation activities.

NCI IS PRODUCING RESULTS

In fiscal year 2001, NCI cofunded 37 projects. The projects established commercial businesses as well as the infrastructure needed to encourage and support the development and growth of commercial enterprises. Products and technologies represented by NCI projects have included medical technologies, software services, automotive technologies, physical security systems, and light manufacturing. Examples of commercial enterprises that are on the road to self-sustainability include: two open computing centers (Sarov and Snezhinsk); a Software Development Center (Zheleznogorsk); ITEC physical security systems manufacturing (Snezhinsk); kidney dialysis equipment production (Avangard); and biological materials production (Zheleznogorsk). Commercial infrastructure supported by NCI in each city includes staffed and resourced business centers, telecommunications infrastructure, technoparks, business training modules and facilities, and loan centers that provide easier credit access.

There are more than 35 potential commercial partners for projects in the NCI cities, and 10 are already in place. These potential or actual partners include such names as Fresenius Medical Care, Credit Suisse, Novosoft Software, Adapco, Gazprom, Luxoft Software, Eurasia Software, Motorola, Delphi Automotive, and General Electric.

Along the road to commercial sustainability and economic diversification of the cities, NCI projects have received more than $21 million in leveraged funding from sources outside the program.

FROM PLANNING TO IMPLEMENTATION

As NCI begins program activities in each city, it implements several stages of operations. These stages are often overlapping.

First, an assessment is made of city capabilities, existing technologies, personnel resources, and the like. Small evaluation teams assess site conditions and meet with local representatives in a collaborative environment. Second, strategic plans for implementation are jointly developed based on the assessments. NCI facilitates the creation of a vision and plan for implementation by principal interested parties in the community, including government and business entities. Projects are evaluated for commercial viability, and business plans are developed for promising proposals. Strategies are developed to create commercial businesses and infrastructure. Third, sources of external financing and partners to participate in the projects are sought. NCI's role in commercialization is to be a facilitator rather than a primary funding source for projects. Substantial economic development requires partners and financing from internal and external sources. Fourth, for projects that can be implemented with available U.S., Russian, and other resources, the projects are managed using contracts, project management methods, and financial controls. Fifth, NCI provides continuous mentoring for project plans and implementation. This includes exchange visits to the U.S. for city and institute managers, training in business techniques for managers and staff, and evaluation of project proposals using Western business practices.

Finally, NCI has an exit strategy. The objective is to place each nuclear city on the path to economic diversification and sustained commercial development, to support our joint nonproliferation goals of weapons complex downsizing and alternative employment for displaced workers. The NCI exit strategy is to complete program activities and move on to new cities once these program goals are met.

DEVELOPING LOCAL INFRASTRUCTURE, BUSINESS TRAINING, AND EXCHANGES

A key strategy of NCI is to develop local infrastructure to support economic diversification and job creation. One example of this is the International Development Centers (IDCs) created in Zheleznogorsk and Snezhinsk. The Zheleznogorsk IDC was opened in November 1999. It currently serves more than 200 clients each month, with 1,350 customers in the last six months. It provided project analyses to the City Investment Commission, which received $17 million from the Russian government for 14 projects. It serves as coordinator and contractor for the city administration on NCI activities. It served as the model for development of a second IDC in Snezhinsk, which opened in June 2000. Plans are under way to use the experience of these first two IDCs to develop a business center in Sarov in the near future.

Telecommunications is another area in which NCI has been instrumental in building commercial infrastructure. In each city an expanded

internet bandwidth was required to meet the crucial need for business communications. In the West, business moves at the speed of the Internet, and adequate telecommunications facilities are needed in order to be competitive. As a first step in each city, NCI purchased satellite bandwidth and replaced antiquated equipment. Next, fiber optic cable was installed, as needed, to the nearest hub to provide good speed at lower cost, avoiding the future use of expensive satellite services. Finally, Internet service provider (ISP) businesses were created or expanded to provide continued support of the telecommunications infrastructure.

NCI also creates intangible infrastructure in the form of business training and exchanges. These important ingredients of commercial success are needed to improve marketing and management of businesses and projects. Training has included sessions on business plan development, managerial leadership, project management, marketing, and English language instruction. Related to this, there have been numerous exchanges bringing Russian managers to the United States to visit commercial firms of many types and learn first-hand the reasons for their success. These exchanges have also focused on the technology spin-off experience of the U.S. weapons complex in its downsizing efforts.

CREATING COMMERCIAL BUSINESSES

A number of promising proposals were received during initial assessments of city resources. As noted, in FY01 alone, 37 projects were funded by NCI. An example of this is the work to develop software development businesses in each city. Open Computing Centers (OCCs) were established in Sarov and Snezhinsk to use the considerable software talents of displaced workers in the weapons design institutes. NCI funded construction of the OCCs, as well as staff training and salaries, to demonstrate their capabilities to potential Western clients. Today, most of this demonstration work has been completed, and several commercial contracts are in place. More recently, a different model is being used in Zheleznogorsk to develop a software center, similar to the approach used by Obninsk. Under the Zheleznogorsk approach, a competitive solicitation identifies a successful software development firm, which is then invited to the city as a partner. The firm supplies its experience and marketing resources in setting up a new business. In Zheleznogorsk the software partner, Novosoft, is supported by NCI and the city administration through funding of start-up facilities and equipment, as well as support in making Western customer contacts. The partner brings its marketing and technical skill, as well as its track record, to make a successful business at the new location. Over time, the new business will employ an increasing number of displaced weapons workers as it expands.

Other businesses supported by NCI that are on the way to commer-

cial self-sustainability include those in medical technologies, security equipment production, and other light manufacturing.

LEVERAGED FUNDING

The plans of Minatom for downsizing the Russian weapons complex will require a large resource commitment over several years. The role of NCI is to facilitate conversion and economic diversification activities in the nuclear cities but not to fully fund them with its own resources. Substantial additional funding and effort will be needed from other sources. Minatom is contributing almost $4.8 million on projects supported by NCI, in addition to other Russian government funds in support of defense conversion efforts in nuclear cities. NCI has also brought private partner resources to the cities. Private industry commercial contracts and contributions supporting NCI activities are valued at more than $1 million thus far, and are increasing.

The European Bank for Reconstruction and Development (EBRD) provides support to the nuclear cities through easier access to loans from its $300 million Russia Small Business Fund. NCI signed an agreement with EBRD to set up loan offices in each city. This initial investment has already resulted in more than $1.5 million in loans for small businesses, with the promise of many more loans to come. In the United States, access to capital, often in the form of small business loans, is essential for economic development. By investing in the commercial infrastructure needed to set up these local EBRD loan offices, NCI was able to leverage its funding with a much larger pool of resources.

CONVERSION AT AVANGARD

Sarov has the highest funding priority among the three NCI cities, in line with Minatom's expressed priority to accelerate conversion and shut down the Avangard weapons assembly/disassembly plant. More than ten acres of production space was carved out of the Avangard facility to form a technopark. Six buildings with a total of 20,000 square meters of space were converted to commercial use. This first required moving sensitive defense materials and equipment from the facilities, and then moving the fence from the high-security area to form a commercial area that only requires an industrial level of security. All of this work was conducted by Avangard under contract to NCI. Facilities for nuclear weapons work were converted to facilities for the production of kidney dialysis equipment, in cooperation with the Western partner Fresenius. The project was also leveraged with funds from the International Science and Technology Center (ISTC) and the DOE nonproliferation program Initiatives for Proliferation Prevention (IPP).

Additional commercial possibilities have been identified for other buildings in the Avangard Technopark, and plans are under way to move another portion of the fence to permit additional commercial work. Production space is currently being developed for automotive parts; electrical switch gear; materials protection, control, and accounting (MPC&A) equipment; oil and gas instruments; and other commercial production.

FUTURE NCI ACTIVITIES

Having just completed its second full year of operations, NCI is planning for future program activities. The closure of Avangard is of the highest priority, and significant resources will be applied to further develop the Avangard Technopark. In all three cities, additional support will be provided to current projects that are poised for commercialization, completing project implementation activities and adding additional resources where needed. New projects to accelerate facility downsizing and provide alternative employment opportunities for displaced weapons workers will be identified, evaluated, and funded. Although much commercial infrastructure has been built, NCI will continue to support business infrastructure where needed. This will include continued funding for the IDCs and additional business training and exchange trips for Russian managers to gain experience in the United States. Finally, depending upon continued budget support from the U.S. Congress and Russia's downsizing priorities, NCI will likely apply the strategies developed in the three pilot cities to additional cities in the future.

Analysis of the Results of the Targeted Program for Promoting Employment for the Population of Minatom Closed Administrative-Territorial Zones for 1998–2000

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In 2000, positive trends continued in the development of industrial production and atomic power engineering within the Minatom (Ministry of Atomic Energy) system. The state order was fulfilled according to the established tasks and limits.

The rate of growth of industrial manufacturing output volume totaled 109.3 percent in 2000 (109 percent for Russia as a whole), while 103.5 percent is predicted for 2001 (in comparison with the previous year, in comparable prices). The growth of output volumes in 2000 is basically associated with the increase in electric power production at atomic power plants and the corresponding growth of manufacturing output volume in the nuclear fuel industry.

The active implementation of measures included in programs providing employment assistance to the population has had a substantial impact in reducing tensions in the registered labor market. The process of layoffs at enterprises and organizations has slowed, while the number of individuals placed in temporary jobs has increased. The number of participants in public works projects is also growing.

Thanks to funds attracted, as well as the use of outside investments, local government agencies in the closed administrative-territorial zones have carried out projects to create enterprises in the following fields:

- manufacture and processing of food products (Zheleznogorsk, Lesnoi, Ozyorsk, Seversk, Snezhinsk)
- light industry (Novouralsk, Seversk)

[*] Translated from the Russian by Kelly Robbins.

- manufacture of water pipes and sanitary equipment using promising new materials (Tryokhgorny)
- wood processing (Zheleznogorsk, Lesnoi)
- retail trade and the service sphere (Zheleznogorsk, Lesnoi, Seversk)
- construction and renovation of the urban infrastructure, housing, and public facilities (Lesnoi, Novouralsk, Ozyorsk, Sarov, Seversk)
- industrial and domestic waste processing (Zheleznogorsk, Novouralsk)
- manufacture of medical preparations (Zheleznogorsk, Sarov)
- processing of local mineral raw materials (Zheleznogorsk)
- agricultural production (Lesnoi)
- sports and tourism (Tryokhgorny) and a number of others

Within the framework of the Targeted Program for Promoting Employment for the Population of Closed Administrative-Territorial Zones of the Russian Ministry of Atomic Energy for 1998–2000, and thanks to the resources provided by those executing the program, about 13,300 jobs were created and preserved in 2000. More than 1,250 people took part in public works projects, and 1,200 were provided with job training. (See "Report on Implementation in 2000 of Measures from the Federal Targeted Program of Employment Assistance to the Population of the Russian Federation for 1998–2000," Russian Ministry of Labor, February 27, 2001, No. 448, Appendix 1, pages 21–22.)

SITUATION IN THE EMPLOYMENT SPHERE

From 1994 through 2000 the number of unemployed persons in the Minatom closed zones registered by local employment service agencies of the Russian Ministry of Labor rose to 4.8 percent in 1996 and fell to 2.2 percent in 2000 (see Tables 1 and 2).

TABLE 1 Size of Economically Active Population and Overall Registered Unemployment Rate in Minatom Closed Zones, 1994–2000

Registered as of End of Reporting period	1994	1995	1996	1997	1998	1999	2000
Economically active population	416,120	413,900	411,130	416,880	416,770	426,750	417,090
Number of unemployed registered by local agencies	9,480	16,970	19,980	18,040	19,590	13,660	9,180
Registered unemployment rate (%)	2.3	4.1	4.8	4.3	4.7	3.2	2.2

TABLE 2 Registered Unemployment Rate in Minatom Closed Zones, 1994–2000 (in percentages)

City (Closed Zone), Region	1994	1995	1996	1997	1998	1999	2000
Russian Federation	2.3	3.3	3.6	2.9	2.9	1.8	1.4
Zheleznogorsk	2.0	6.0	6.0	5.8	3.1	1.5	1.1
Krasnoyarsk Territory			3.8	3.8	4.3	3.4	2.6
Zarechny	6.2	8.8	8.2	6.8	7.9	5.8	3.1
Penza Oblast			6.2	5.7	3.8	1.9	1.6
Zheleznogorsk	2.6	2.3	3.1	2.0	2.9	2.7	2.7
Krasnoyarsk Oblast			3.8	3.8	4.3	3.4	2.6
Lesnoi	2.7	3.7	4.0	2.9	5.5	3.8	3.6
Sverdlovsk Oblast			3.3	2.7	2.7	1.5	1.5
Novouralsk	0.5	2.6	4.7	4.7	6.3	4.2	2.9
Sverdlovsk Oblast			3.3	2.7	2.7	1.5	1.5
Ozyorsk	1.0	1.9	3.6	4.6	5.8	3.2	2.3
Chelyabinsk Oblast			2.2	1.9	2.0	1.1	0.9
Sarov	0.5	1.5	2.3	1.7	2.4	2.0	1.2
Nizhny Novgorod Oblast			3.1	2.6	2.4	1.0	0.7
Seversk	3.7	6.3	7.3	5.9	5.1	3.6	2.0
Tomsk Oblast			3.8	3.6	4.0	2.4	2.0
Snezhinsk	1.8	2.2	2.8	1.8	2.7	1.4	0.8
Chelyabinsk Oblast			2.2	1.9	2.0	1.1	0.9
Tryokhgorny	3.4	6.0	5.4	6.9	5.8	4.5	2.7
Chelyabinsk Oblast			2.2	1.9	2.0	1.1	0.9

NOTE: Figures are shown for registered unemployment rates in Minatom cities (closed zones) in which unemployment levels exceed levels for the regions in which the cities are located. Blank cells in the table indicate that no data are available for those periods.

By the beginning of 2000, the unemployment rolls included 13,656 people, of whom 63 percent were women and 38 percent were young people between the ages of 16 and 29.

During 2000 the proportion of unemployed citizens who had been registered with the employment service for more than one year fell from 25.1 percent to 16.8 percent. Stagnant unemployment was reduced as the average duration of unemployment tended to decline, totaling 5.1 months as of January 1, 2001, as compared with 7.1 months as of January 1, 2000. The duration of unemployment was reduced as follows:

- among men, from 6.2 to 5.1 months
- among women, from 7.6 to 6.7 months
- among citizens living in urban districts, from 7.0 to 6.0 months
- among citizens living in rural districts, from 8.4 to 7.0 months
- among young people 16–29 years of age, from 6.3 to 5.4 months

The number of job vacancies at the end of 2000 increased in comparison with 1999, totaling 19.8 percent, or 3,850 open positions. Requests to

employment service agencies by enterprises wishing to fill open jobs totaled 1,393 in 1999 and 3,850 in 2000, an increase of about 280 percent. Demand for workers in the state sector of the economy also rose, representing 29.6 percent of total demand in 1999 and 38.2 percent in 2000. More than 80 percent of vacancies were in blue-collar fields, and the majority of the requests were for men. During 2000 the labor market intensity coefficient (number of unemployed citizens registered with the employment service for every one vacancy) decreased by almost 43 percent, going from 4.2 individuals per job opening to 2.4.

A total of 1,025 people, or 6.3 percent of the total registered as unemployed during the year, took part in public works projects in 2000.

The number of unemployed who received unemployment benefits during 2000 was 17,323. Material assistance has been established for unemployed citizens and their family members for cases in which unemployment benefits have run out owing to the expiration of the legally established eligibility period.

Despite the drop in the total number of unemployed and the continuing positive factors of development, the trend toward improvement in the condition of the labor market cannot be termed stable. There are a large number of vacancies in the labor market, but these jobs are not in demand for the following reasons: the majority of vacancies are for men, offer low wages, and are at enterprises where payment of wages is often delayed. Women and young people represented an increased portion of those laid off. The number of citizens requesting job placement assistance or receiving psychological, legal, and career guidance services has risen by 37 percent.

LABOR DEMAND OUTLOOK

A critical situation could develop in the labor market in the closed zones during implementation of the Federal Targeted Program for Reform of Atomic Industry Enterprises (Nuclear Weapons Complex) for 2001–2005 and for the period up to 2010. Measures included in this program call for enterprises of the nuclear weapons complex to lay off 30,000–35,000 people during the specified period.

The biggest and most intensive efforts on conversion in the industry are to be carried out during the first stage of the reform program (2002–2005), which will require significant state support. Thanks to the development of conversion-oriented manufacturing enterprises, about 30,000 new jobs will be created for workers laid off from the defense sector.

To ensure socioeconomic development and provide jobs for the population, local government agencies in the Minatom closed zones are carrying out investment projects to create small- and medium-sized enterprises in the following fields: production and processing of food products; pro-

cessing of wood and local mineral resources; construction and renovation of urban infrastructure, housing, and public facilities; processing of industrial and domestic waste; manufacturing of metal and plastic goods and medical preparations; retail trade and the services sphere; agricultural production; light industry; sports; tourism; and a number of others. These projects are being carried out with funds from local budgets and from outside investments.

The job creation efforts being undertaken by local self-government organs and by the management of the Minatom enterprises around which the closed zones center will make it possible to ensure employment for the population of the Minatom closed zones. They will also help to prevent the growth of mass unemployment in connection with layoffs during the reorganization and reform of nuclear weapons complex enterprises.

KEY PROBLEMS REGARDING EMPLOYMENT OF THE POPULATION IN MINATOM CLOSED ZONES

According to provisions of the subprogram Reform of Atomic Industry Enterprises (Nuclear Weapons Complex) for the period to 2010 of the Federal Targeted Program for Reform of the Defense Industrial Complex for the period to 2010, the following represent key problems regarding employment of the population and personnel and social policy in the Minatom closed zones:

- preserving and developing collectives of highly skilled specialists and workers
- consolidating personnel around the fundamental development tasks for the industry
- sharply increasing labor productivity (output per worker)

In addressing the above-specified problems it is necessary to support

- preserving and effectively augmenting the personnel potential of the industry and stepping up efforts aimed at training and attracting young specialists and scientific personnel, selecting and assigning managers, and working with the reserve pool
- identifying specialists with critical knowledge that is key to the main thematic directions of activity in the industry and creating a system of priorities in wage payment, work organization, and resolution of social questions
- developing international cooperation in the training of specialists and creating the necessary training methodology base, training simulators, equipment, manuals, and documentation

- improving efforts to organize and equip workplaces, developing and implementing measures to improve workplace safety and safety equipment, and systematically improving qualifications as foundations for increasing labor productivity
- preserving existing jobs and creating new ones during the process of enterprise conversion and reconstruction and placing top priority on the development of high-tech science-intensive production facilities
- developing and improving the system of interaction of Minatom with government agencies at the federal, local, and Federation-subject levels in the aim of developing and implementing programs to create conditions favorable for outside investors, preserve and foster scientific and industrial potential, and create new manufacturing enterprises
- preserving and developing the industry-wide corporate system for ensuring social protection of workers in the industry, providing for their medical-sanitary and pension needs, and organizing worthy conditions for work and rest
- developing cooperation with regional government agencies on questions of employment of the population, socioeconomic development, education, culture, housing construction, social insurance, and so forth
- establishing mechanisms for the granting of housing on credit at enterprises of the industry, including mortgage lending, that will guarantee the provision of housing to workers and their family members, especially young specialists

Social and personnel efforts in the industry should make it increasingly attractive in the aim of maintaining collectives of highly qualified specialists.

The objectives established in social and personnel policy are pursued through the use of consolidated financial assets and include the following key points:

- implementing a uniform industry-wide corporate system of social protection for workers in the industry that provides for their pensions and medical care and ensures the organization of comfortable conditions for work and rest
- preserving and effectively augmenting the personnel potential of the industry and coordinating efforts regarding the training of young specialists and scientific staff and the selection and placement of managers
- expanding interaction with local government agencies in the closed administrative-territorial zones regarding employment of the population, social insurance, housing construction, and socioeconomic development
- preserving the existing system of social insurance for workers in the industry
- preparing and adopting the necessary regulatory measures ensuring completion of a certain amount of housing space annually to improve housing conditions for workers in the industry

- establishing mortgage lending mechanisms at industry enterprises to guarantee housing opportunities for young specialists sent to work at industry enterprises, which should reduce turnover at nuclear weapons complex enterprises and ensure timely replacement and continuity of workers with critical knowledge and skills

The strategy of regional development is substantially based on the promotion and use of effective technologies in production and management and on the creation of linkages with new partners. This gives enterprises, and especially closed zones, new opportunities to expand their activities by participating in the development and implementation of regional strategies. With the implementation of major projects in the regions to create new science-intensive and innovative production facilities using civilian nuclear technologies in cooperation with regional governments and domestic and foreign partners, the enterprises of the Minatom closed zones will gain new business and be able to use their significant technological and industrial potential more effectively.

GOALS AND TASKS OF THE PROGRAM

The goals and tasks of the program are determined by the Federal Targeted Program for Promoting Employment for the Population of the Russian Federation for 1998–2000, which was authorized by Resolution No. 828 of the Government of the Russian Federation dated June 24, 1998. (See Collected Legislation of the Russian Federation, 1998, Volume 33, Article 4005, and 1999, Volume 26, Article 3184.) These goals and tasks are based on a general agreement among the all-Russian associations of trade unions, all-Russian associations of employers, and the Government of the Russian Federation for 2000–2001. They are also based on the current Industry Wage Agreement for the Atomic Power Industry and the concept of reforming Minatom as presented in the subprogram Reform of Atomic Industry Enterprises (Nuclear Weapons Complex) for the period to 2010, which is part of the Federal Targeted Program for Reform of the Defense Industrial Complex for the period to 2010.

The basic goal of the program is to provide employment for the population of the Minatom closed zones and prevent the mass growth of unemployment in connection with layoffs of workers during the reorganization and reform of nuclear weapons complex enterprises. The main tasks of the program are as follows:

- preserving, developing, and effectively utilizing existing industrial, technological, and personnel potential of the enterprises in the closed zones during the reorganization and reform of Minatom

- reorienting laid-off personnel to the development and production of civilian goods and services
- supporting and developing entrepreneurship and self-employment among the population
- organizing temporary jobs and public works employment

In all, the program calls for creating 17,800 new jobs, providing temporary employment in public works projects for 44,900 people, and providing retraining or training in new professions for 185,300 people. The program is to be carried out from 2002 through 2005. Tables 3, 4, and 5 provide data on the program for the city of Zarechny.

KEY AREAS OF PROGRAM ACTIVITIES

The key areas of program activities in accomplishing the tasks set for the Minatom closed zones are as follows:

- improving employment-related laws and regulations in closed zones (conditional work, wages, employment assistance for laid-off workers, improvement in the quality and professional development of the workforce, and so forth). In particular, this pertains to the competence of managing bodies of the industry and to opportunities for their initiative.
- creating and preserving jobs
- increasing the efficiency of labor utilization
- reorganizing and reforming production (basic activity) as a source of jobs
- promoting improvement of the qualifications and professional mobility of personnel and working with the vocational education system to improve the professional skill structure of personnel in the closed zones
- ensuring staff rotation to replace highly qualified specialists who have retired from the industry
- providing employment assistance for vocational school graduates and young specialists
- developing labor markets at the industry, municipal, and enterprise levels and providing employment assistance for laid-off workers, especially those from enterprises around which the closed zones are based, by resettling them in other regions, placing them in jobs at other industry enterprises, and providing them with housing
- organizing temporary jobs and public works projects
- developing social partnership in the industry, in municipal organizations, and at enterprises
- expanding interaction of closed-zone enterprises with executive-branch agencies of Russian Federation subjects and regional agencies of the Russian Ministry of Labor regarding employment-related issues

TABLE 3 Employment Situation in Zarechny and Related Assistance Measures

		Volume of Financing (in rubles)					
	Target of Measures	Including: 2002–2005	2002	2003	2004	2005	Source and Financing
Zarechny	Citizens discharged from military service and their family members	76,230 38,110	11,860 5,940	16,350 8,170	21,600 10,800	26,400 13,200	Fed.Budget Ministry of Labor
	Number of persons	65	12	15	18	20	
	Persons nearing retirement age	161,200 30,240	10,800 5,400	13,800 6,540	16,800 8,400	19,800 9,900	Fed.Budget Ministry of Labor
	Number of persons	51	10	12	14	15	
	Persons released from prison	30,030 15,010	2,980 1,490	5,450 2,720	8,400 4,200	13,200 6,600	Fed.Budget Ministry of Labor
	Number of persons	25	3	5	7	10	
	Long-term unemployed (six or more months)	331,100 165,550	61,380 30,690	74,120 37,060	90,000 45,000	105,600 52,800	Fed.Budget Ministry of Labor
	Number of persons	285	62	68	75	80	
	Total:	800,600 534,000 266,600	138,000 92,000 46,000	175,700 117,400 58,300	219,600 146,400 73,200	267,300 178,200 89,100	TOTAL Fed.Budget Ministry of Labor
	Number of persons	456	92	107	122	135	

TABLE 4 Assistance to Development of Self-Employment and Entrepreneurial Initiative

		Volume of Financing (in rubles)					
	Target of Measures	Including: 2002–2005	2002	2003	2004	2005	Source and Financing
Zarechny	Assistance to development of self-employment and entrepreneurial initiative	200,400	22,500	39,600	54,450	83,850	Fed.Budget
		200,400	22,500	39,600	54,450	83,850	Ministry of Labor
	Number of persons	37	5	18	10	14	
	Program to support development of entrepreneurship and self-employment, including:						
	Training unemployed and nonworking population in basics of entrepreneurial activity	111,200	12,500	22,000	30,200	46,500	Fed.Budget
		55,600	6,250	11,000	15,100	23,250	Ministry of Labor
	Number of persons	37	5	8	10	14	
	Providing financial help to organize entrepreneurial activity	289,500	32,500	57,200	78,700	121,100	Fed.Budget
		144,950	16,250	28,600	39,500	60,600	Ministry of Labor
	Number of persons	37	5	8	10	14	
	Total:	1,002,100	112,500	198,000	272,400	419,200	TOTAL
		601,100	67,500	118,800	163,400	251,500	Fed.Budget
		401,000	45,000	79,200	109,100	167,700	Ministry of Labor
	Number of persons	111	15	24	30	42	

TABLE 5 Material Support for Persons Recognized as Unemployed

		Volume of Financing (in rubles)					
	Target of Measures	Including: 2002–2005	2002	2003	2004	2005	Source and Financing
Zarechny	Payment of unemployment benefits	56,893,100	8,756,000	11,471,000	16,149,700	20,516,400	Ministry of Labor
	Persons	7,885	1,440	1,715	2,195	2,535	
	Rendering of material and other aid	90,600	14,300	18,100	25,500	32,700	Ministry of Labor
	Persons	348	65	75	96	112	
	Vacations for children of unemployed citizens	889,000	138,500	178,600	254,200	317,700	Ministry of Labor
	Persons	314	58	68	88	100	

EVALUATION OF EXPECTED EFFECTIVENESS OF PROGRAM

Implementation of the program will substantially lessen the acuteness of such an important social problem as unemployment, which is caused by the sharp reduction of production volumes for the manufacture of defense-related and other traditional output at nuclear weapons complex enterprises in the Minatom closed zones.

Measures for restructuring nuclear and chemical manufacturing enterprises call for them to increase their total output volume of civilian products to 220 percent of year 2000 levels by 2010. Products intended for export should be increased by 120 percent, while export goods should total 39.7 percent of overall production output.

In the course of implementing measures for structural optimization and restructuring, assembly line enterprises of the nuclear weapons complex are to increase their total output volume for civilian goods to 500 percent of year 2000 levels by 2010. Output of products intended for export is to be increased by 180 percent.

Plans call for the creation and start-up of industrial facilities that will make it possible to produce competitive civilian products valued at 29.5 billion rubles. The proportion of export-oriented products will reach 37.7 percent of the total output volume of conversion-related goods by 2010. The recoupment period for these investments will be two or three years, and the development of these conversion-oriented manufacturing facilities will create about 30,000 jobs for workers laid off from the defense sector.

To ensure stable socioeconomic development and provide jobs for the population, local government agencies in the Minatom closed zones are carrying out investment projects to support and develop entrepreneurship and self-employment among the population. These projects are being carried out with funds from local budgets and from outside investments.

Local government agencies and the management of enterprises around which Minatom closed zones are based are jointly carrying out measures to create new jobs. These measures will make it possible to provide employment for the population in the Minatom closed zones and prevent the growth of mass unemployment in connection with layoffs of workers during the reorganization and reform of the enterprises of the nuclear weapons complex. Some 17,800 new jobs will be created as a result of programmatic measures to be carried out during 2002–2005.

All projects proposed for implementation within the framework of the program are subject to a mandatory environmental impact assessment and will facilitate a substantial improvement in the condition of the environment in areas adjoining nuclear facilities in the closed zones. The basic tasks concerning ecology and industrial waste management at enterprises in the industry include

- ensuring the ecological safety of atomic power plants and related industrial facilities during their operation and decommissioning
- providing for the safe handling of radioactive and toxic wastes during their formation, transportation, processing, storage, and final disposition (burial)
- rehabilitating natural sites (land areas and bodies of water) polluted with radioactive or toxic wastes during the operation of atomic power plants and related industrial facilities

To improve safety for the storage of environmentally hazardous radioactive wastes, a set of measures is planned to renovate and construct warehouses and storage facilities, taking into account the increased demands of safety rules and SNIIP-90. Further measures will be aimed at conservation of storage facilities for radioactive mine tailings.

Along with the decommissioning of nuclear facilities, radiation sources, and storage points for nuclear materials, radioactive substances, and wastes, a range of efforts is under way to dismantle contaminated equipment and structures. The rehabilitation of environmental sites (land areas and bodies of water) contaminated with radioactive or toxic wastes during the activity of industry enterprises includes a set of measures to be carried out at industrial sites, in sanitary-protective zones, and in zones under enterprise supervision.

MANAGEMENT AND CONTROL OF PROGRAM IMPLEMENTATION

Fundamental control of program implementation is carried out by the Minatom industry commission that directed the development of the program. Local government administrations in the closed zones and regional employment offices of the Russian Ministry of Labor also participate in this work, along with the Union of Employers in Atomic Engineering, Industry, and Science of the Russian Federation (SRMAE) and the leadership of the Russian Trade Union of Workers in the Atomic Power and Related Industries (RAEP).

The basic task of the industry commission is to ensure that the fundamental goals of the program are achieved in a highly cost-effective manner. In accordance with this goal, the commission carries out the following functions:

1. At the program development stage
   - definition of goals and ways of achieving them
   - determination of work structure and implementers for the entire program period
   - coordination, correction, and approval of the program

2. At the program implementation management stage
   - monitoring of program performance overall and for individual tasks
   - analysis of current status of work and forecasting of possibilities of achieving program goals
   - development, implementation, and monitoring of the execution of management decisions

The mechanism for monitoring program implementation consists of the following elements:

- preparation of annual reports on progress made in carrying out basic program activities, financial resources expended, and the degree to which results obtained correspond to the expected outcome
- presentation of reports to the leadership of Minatom, SRMAE, and RAEP so that they can be jointly discussed and the appropriate corrections can be made in the program

The industry commission includes an information service and management group that analyzes the status of work and prepares information for decision making and operational management of program implementation.

One of the most important organizational-economic conditions promoting successful implementation of the program is its inclusion in the Federal Targeted Program of Employment Assistance to the Population for 2002–2005 and the distribution of the corresponding forms of state support to the enterprises participating in realization of the program.

Technobusiness in Russia's Atomic Cities

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During 1998 and 1999 a Russian-American team investigated the development of small innovative businesses and related activities in the cities of Snezhinsk, Zarechny (Sverdlovsk Oblast), and Obninsk. Snezhinsk is a closed city, Zarechny is open but with controlled access, and Obninsk is open. Thus, there was an opportunity to consider the impact of limitations on access to the cities and the significance of different geographical and historical factors on the evolution of businesses in the cities.

The team gave special attention to several characteristics and activities of the cities and reached the following conclusions:

- Each of the cities has certain tax and other privileges provided by the federal and/or regional governments. In return, the enterprises and institutes in the cities should contribute to economic development not only within the municipalities, but also throughout the regions.
- Federal policies should facilitate technological development, including prompt payment of local taxes by federal facilities to help support local technology initiatives, establishment of stable and equitable energy prices to increase competitiveness of productive enterprises, and support for telecommunications infrastructures that enable businesses to reach out to new customers.
- Innovating for profit is critical to the future of the cities. To this end, the federal government should establish a stable tax regime, enforce protection of intellectual property, give preference to Russian suppliers of high-tech goods and services in government procurements, and enforce payment of duties on imports of high-tech foreign goods.

- Young people must become technology advocates. More emphasis should be given to high school olympiads, summer computer camps should be expanded, all college students should have Internet access, and work-study programs should be expanded for technology-oriented students.
- International programs should be truly collaborative with equitable sharing of the rights to intellectual property generated in cooperative activities, more emphasis on long-term sustainability of programs, and increased portions of Western funding available for expenditures in Russia.

The Russian-American team is gratified that this workshop responds to one of the specific recommendations of the team's report, and we look forward to improving our insights into the future for small innovative firms in the nuclear cities.

Innovation Activity in Russian Higher Education

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ANALYSIS OF THE PROBLEM

The scientific-technical sphere in Russia is today experiencing times that are not the best. Despite the presence of significant scientific developments, the high level of education of personnel in the scientific-technical sector, the potential need of industry to modernize its production facilities, significant capital assets in the production and research spheres, and the presence of much accumulated capital in the country, innovation activity is developing poorly. The basic reasons for this situation go beyond the lack of coordination of the efforts of federal agencies, the insufficiency of investment resources, and the shortage of budgetary funds to finance scientific-technical programs that have been adopted. They also lie in the poorly developed nature of the domestic market for scientific-technical knowledge, the as yet undeveloped system for commercializing scientific developments and technologies, and the inconsistency of levels of development of the infrastructure for innovation activities at both the federal and regional levels.

Various branches of industry are seeing a curtailment of production of science-intensive products that set the engineering and technical standards. Innovation activities are being cut because of the impact of the low payment capabilities of customers for scientific-technical products in both the state and nonstate sectors of the economy. Under conditions characterized by severe demand limitations, enterprises are primarily reducing

* Translated from the Russian by Kelly Robbins.

output volumes for science-intensive products, in part replacing them with technically simpler and cheaper goods.

Innovation policy is a powerful tool, with the help of which it is possible to overcome the economic downturn, ensure economic restructuring, and fill the market with a variety of competitive products. Today, with the current sharp deficit of investments, the country needs constructive platforms and action programs.

A way out of the current situation that will ensure a broad-scale, dynamic, and stable flow of innovative processes may be found by implementing a powerful state innovation policy aimed at concentrating financial resources and state participation in the development of a regional infrastructure for innovation activity. Other key points include creating a system for providing information through all stages of the innovation cycle, conditions for close cooperation between science and industry and industry and the market, a legal system and environment for technology commercialization with the requisite protection for domestic scientific-technical developments, and conditions for attracting private investments to innovation activity. Implemented with the help of state innovation programs, the concentration of funds on infrastructure creation in the scientific-technical spheres will, with the help of the newly created mechanism, promote an effective solution for the problem of intensifying innovation activity.

Instead of the rather ineffective process of saving Russia's scientific-technical potential, a strategy must be found to activate scientific-technical resources and develop science-intensive innovation activity on a massive scale. It is infrastructural support that allows small enterprises to gain access to production facilities, which is essential in adequately meeting the fundamental objectives involved in producing innovative goods.

An analysis of the economic situation in Russia, taking into account existing world experience, indicates that economic recovery and the restoration of production facilities can be expected as a result of increasing the number and volume of small high-tech firms based on commercializing the newest achievements of science and engineering. This sphere of entrepreneurial innovation activity is extremely poorly developed in Russia today. One of the basic reasons for the insufficiently quick and effective development of innovation activity in the scientific-technical sphere lies in the problem of personnel training and retraining.

A critically important internal precondition for the enhancement of existing scientific-technical potential is the development in Russia of small innovative firms and venture capital-oriented science-intensive structures based on various forms of property ownership. Also important are such qualitatively new economic structures as business innovation centers, business incubators, research and technology parks, engineering centers,

consulting firms, and others, which serve the interests of innovative firms and are primarily based at higher educational institutions.

Higher educational institutions possess powerful intellectual potential, which will help in

- forming collectives of specialists who are highly qualified in a wide range of fields of innovation activity, including the production and marketing of new inventions throughout the entire innovation process cycle
- attracting the necessary material-technical base
- using already accumulated experience in the creation and operation of new economic forms of innovative and commercial activity, including experience in international cooperation
- forming an effectively operating system for commercializing technologies and other scientific-technical results obtained in higher educational institutions, which will help these institutions earn money
- forming an additional new educational environment founded on the innovation-oriented path for developing the world community, which will help higher educational institutions train and retrain personnel capable of converting intellectual property to salable goods under market conditions
- stimulating the development of top-priority fields of scientific-technical research
- maintaining and developing research collectives in higher education under conditions marked by inflation and the destruction of the system for production and sales of scientific-technical output
- preserving jobs and creating new ones for the staff members of higher educational institutions
- creating the necessary methodological support for innovation activity (to exert influence on other industries in the country as on scientific-technical policy in the regions)
- creating, developing, and testing under the new economic conditions the new infrastructure for innovation activity and new economic structures (technoparks, centers, foundations, firms, etc.) ensuring civilized means for commercializing technologies and bringing intellectual property to the market
- creating the foundations for training personnel for involvement in innovation activity
- beginning work on the formation of regional innovation centers based on bilateral agreements with regional administrations

The Russian higher education system currently employs more than 180,000 staff members with the *kandidat* degree (equivalent to the U.S. doctorate) and more than 18,500 with the higher doctor of sciences degree. In addition, there are almost 3,000 people working toward the doc-

tor of sciences degree and more than 60,000 graduate students working toward the *kandidat*.

To facilitate achievement of the above-listed work objectives for higher education, more than 70 technoparks have been created under the auspices of Russia's leading higher educational institutions. At these parks, efforts are also under way to create innovation technology centers and complexes. In addition, more than 10 regional innovation centers have been created, along with 16 regional centers for training specialists in innovation entrepreneurship, 12 regional information-analytical centers, and 12 regional centers for promoting the development of scientific-technical entrepreneurship. Furthermore, more than 1,300 small innovative enterprises producing and marketing science-intensive products have been created and are operating within the Russian Ministry of Education system.

Thus, a fairly serious infrastructure for innovation activity has been formed to promote the successful completion of innovation projects for 2001–2002, and this infrastructure requires state support in the form of the innovation program.

The development of innovation activity and the implementation of innovation projects in the higher education system are among the top priorities in the educational system of the Russian Federation. Approved by the Scientific-Technical Council and the Board of the Russian Ministry of Education, adopted at a meeting of scientific personnel from the education system, and confirmed by Decree 1705 of the Russian Ministry of Education dated June 6, 2000, the concept for scientific, scientific-technical, and innovation policy in the education system for 2001–2005 instructs higher educational institutions not to limit themselves to developing basic, experimental, and applied research and engineering design projects. Instead, they should develop innovation activity, ensure the commercialization of research and development results, and facilitate the transfer of innovative technologies to the real sector of the economy.

THE INNOVATION PROGRAM OF HIGHER EDUCATION (GOALS, OBJECTIVES, EXPECTED RESULTS)

The basic goal of the program is to facilitate the realization of innovation potential at higher educational institutions by developing the infrastructure of the innovation complex of the educational system, forming training-oriented scientific-innovation complexes at such institutions, creating a system for commercializing the results of scientific research, and getting scientists, instructors, specialists, undergraduates, and graduate students involved in innovation activity. The results of such activity should be used to improve the quality of education of young people and training and retraining of specialists under the new economic conditions

as well as to enhance the role of higher educational institutions as centers for the growth of innovation activity in Russia's regions.

To achieve this fundamental goal, plans call for the following actions:

- increasing the effectiveness of instruments and mechanisms of innovation activity associated with market research, expert review, information support, personnel training and retraining in scientific-technical entrepreneurship and management of scientific-technical and innovation projects, discovery and protection of intellectual property rights, formation of nonmaterial assets as an important financial factor in the stable development of innovation projects by higher educational institutions, certification of finished scientific-technical products, leasing of equipment, and regulatory, legal, and methodological support during implementation of innovation projects
- monitoring, analyzing, and studying innovation potential and innovation activity at higher educational institutions and determining future directions for the development of their innovation complexes
- improving the educational process conducted by higher educational institutions and enhancing the quality of education by introducing the results of innovation activity and strengthening the material-technical base at higher educational institutions; applying modern instructional technologies, including technologies for distance learning; developing up-to-date educational equipment; and creating new textbooks and instructional aids
- creating conditions for the coordination and integration of higher educational institutions with enterprises through the formation of educational-scientific-innovation complexes
- attracting nonbudgetary funding sources for the innovation activity of higher educational institutions
- developing scientific, methodological, regulatory, and legal support for innovative activity in the scientific-technical and educational spheres
- increasing the effectiveness of activity and strengthening linkages among all elements of the innovation complex at higher educational institutions and the educational system to promote the generation, dissemination, and commercialization of new knowledge and technologies created at these institutions
- enhancing the competitiveness of higher educational institutions in the scientific-technical and educational services spheres on both the domestic and foreign markets
- creating conditions for honest competition and entrepreneurship in the sphere of science and scientific support services, as well as providing incentives and support for innovation activity at higher educational institutions

- forming comprehensive interdisciplinary innovation projects involving two or more higher educational institutions to ensure the resolution of major problems facing a region, industry, or group of industries
- developing mechanisms for selecting innovation projects, which must stipulate the applied technology aspect of scientific research to be conducted

The program is aimed at not only obtaining new scientific knowledge (conceptual solutions to scientific problems as a result of basic research), and not only developing new technologies, goods, and materials (technical solutions as a result of scientific research and experimental design work), but also creating and mass producing new technologies, goods, materials, and services using funds provided by outside investors.

Hence, it follows that an innovation project is a project that ends not with the development of a mock-up or demonstration model of an item but with the production of finished goods using outside funding sources that have been attracted. That is, the project must include all procedures associated with commercializing the results of scientific research and developments by scientists working at higher educational institutions and their research and design units.

If at the stage of conceptual resolution of a scientific problem (basic research), the fundamental task of the research manager lies in obtaining financing for basic scientific research, forming a collective, and obtaining new scientific knowledge—or if at the technical resolution stage (engineering research and experimental design work), the chief designer also must obtain financing, create or take charge of a collective of developers (designers, technologists, engineers), and arrive at a new technical solution (new technologies, new goods, new materials)—then at the innovative design stage, the chief project manager must furthermore resolve the problem of assessing the probability of commercializing the developments (technical solutions), conduct market research, promote the future innovation, get the product certified, attract investors, and organize production of the finished product. In other words, he or she must ensure that the needs of citizens, enterprises, industries, or regions for this product are met.

Therefore, the innovation design stage differs substantially from the stages of conceptual solution of a scientific problem and technical solution of the entire innovation cycle.

At the innovation design stage, one sees to a lesser extent the resolution of the problem of, for example, how to obtain various characteristics or parameters in the new product, technology, or material. Such problems are largely dealt with during the preceding stages of the innovation cycle. Here, to a larger extent, is where other problems are resolved—how to attract investors, how to organize production of the finished product, and how to

manufacture it in large volume and market it to the broadest possible spectrum of consumers. Innovation projects submitted to competitions must, for the most part, be carried out by innovation structure at higher educational institutions and by technoparks or innovation-technology centers, as these structures were specially created for such purposes.

In view of the points made above, an innovation project must be headed by a chief manager who is professionally trained to administer and carry out innovation projects. He or she must have professional mastery of mechanisms for commercializing the results of scientific research and development work, as well as experience in transferring technologies from science to production and the social sphere.

The most appropriate personnel to serve as chief managers of innovation projects are mainly directors of university technoparks or specialists who have been trained in innovation management and who work in the innovation structures of higher educational institutions. This will make it possible to define more clearly the roles and place of higher educational institutions and their innovation structures, especially technoparks and innovation-technology centers, in resolving the problem of the innovation activity of higher education. It will also help in increasing the effectiveness of innovation activity in the educational system, especially at the interagency level.

Implementation of the program will promote the following:

- attracting university-based scientists, specialists, and students to innovation activity and using the results of this activity to improve the quality of training provided to specialists, including applying innovative educational technologies
- strengthening the role of higher educational institutions in the country's economy as regional centers for developing innovation activity in the scientific-technical and educational spheres
- creating effective instruments and mechanisms for carrying out innovation projects associated with market research, expert review, information support, and personnel training and retraining
- creating conditions for the coordination and integration of higher educational institutions with the real economic sector by forming educational-scientific-innovation complexes

THE RUSSIAN STATE UNIVERSITY OF INNOVATION TECHNOLOGIES AND ENTREPRENEURSHIP (RSUITE)

Introduction

The advantages of the innovation-oriented path to development are widely employed in the leading countries of the world. These advantages

make it possible to overcome crisis tendencies, diversify production, provide top-priority support for competitive products, commercialize new technologies and create new markets for them, and improve technology management practices.

As the Russian economy is being restructured and the country is making the transition to innovation-oriented development as proclaimed by the President of Russia, the training of specialists for innovation activity in the scientific-technical sphere takes on special significance. These specialists must be capable of bringing scientific ideas to the finished product stage as well as promoting the profitable sales of such products on the domestic and foreign markets. According to the results of an expert analysis, there is a need for about 40,000 people at minimum to be trained as specialists in various spheres of innovation activity, including information systems support, financial and strategic management, investment analysis, design and advertising, marketing, international business, and legal support.

To meet the labor resources need for specialists in innovation activity, it is essential first of all to organize a system for personnel training. The need for creating such a system is recognized by the state, as reflected in a number of federal programs. Support for the educational aspect of innovation activity in Russia is also provided through various international organizations and programs, including the Tacis Program of the European Union, the Peace Corps, the SABIT (Special American Business Internship Training) Program of the U.S. Department of Commerce, the World Bank, the British Know-How Fund, the UNIDO (United National Industrial Development Program) Industrial Partnership Program, and the International Labor Organization.

The Current State of Affairs

Up to now, many of the country's higher educational institutions (especially technical universities) have taken measures to create within their structures nonstandard faculties, departments, institutes, and such for the training, continuing education, and retraining of specialists (mainly on a commercial basis) in such fields as management, marketing, accounting, design, and advertising. However, the basic goal of higher educational institutions in creating these units was to attract additional funds to maintain their fundamental types of activities and preserve their research and teaching staffs. The main point of reference was the existing condition of the labor market. In this regard, it is completely natural that efforts by higher educational institutions to resolve their economic problems quickly were not aimed at the objective demands of society and the state.

The domestic system for training personnel in innovation activity in the scientific-technical spheres is not yet formed; therefore, an objective

need has arisen to create a higher educational institution such as a federal-level training and methodological center oriented toward the training of highly qualified specialists for work in the innovation sphere, conducting research to identify trends inherent in this sphere, and developing a scientific-methodological base for innovation activity. Such an institution must become the nucleus of the entire system for innovation activity in Russian higher education and the guide for innovation policy of the Russian Ministry of Education.

Brief Characterization of the Basic Goals, Tasks, and Differentiating Features of the University

The Russian State University of Innovation Technologies and Business was founded in accordance with Order 2173-r of the Government of the Russian Federation, which was signed by V.V. Putin on December 31, 1999. One fundamental characteristic of the university is that its founders include the Russian Ministry of Industry, Science, and Technology and the Russian Ministry of Economics. These ministries have a great interest in the university's activities inasmuch as they are responsible for forming and implementing innovation policy in Russia. Thus, the activities of the university even at its formative stage are aimed at responding to the needs of society and the state in this sphere.

The university is oriented toward creating and implementing a unified system for training and retraining both specialists in innovation and the development of new innovative technologies and instructors in the corresponding fields. It is called upon to coordinate the efforts of higher educational institutions, industry- and Academy-based research institutes, and regional government agencies to promote economic restructuring and aid in meeting the demands of the current labor market in Russia.

Another important characteristic of the university is that its activities will be carried out in a number of regions of Russia through its branch campuses and offices. Thanks to the use of distance education, the university will be open to the maximum possible number of people wishing to participate. The regional structure of the university will also promote the geographic reach of the country's higher education system into remote and less-populated regions. It will also help resolve economic and social problems in the regions and attract funds from local budgets to the educational process. In this regard, the use of telecommunications technologies will provide the basis for the efficient dissemination, integration, and replication of training and methodological support.

The university is founded on the basis of the State Scientific Institution-Center for Promoting the Development of Scientific-Technical Enterpreneurship in Higher Education, which operates under the auspices of the Russian Ministry of Education. This center has amassed significant experi-

ence in facilitating innovation activity and has 12 branches under the auspices of leading regional universities in various economic regions of Russia (Moscow, St. Petersburg, Rostov-na-Donu, Samara, Voronezh, Novgorod, Ivanovo, Nizhny Novgorod, Yekaterinburg, Tomsk, Krasnoyarsk, and Khabarovsk). It also has a broadly developed network of regional scientific-training centers for innovative business as well as a corporate information network linking a large number of Russian universities.

In this way, the creation of the university is based on the unification of structures already existing within the Russian Ministry of Education system to facilitate innovation activity in higher education. Such an approach has indisputable economic advantages. Considering the orientation toward using existing classroom space at already operating universities and requiring only a minimal amount of new space (for the necessary infrastructure of the new university), these higher educational institutions and branches of the Center for Promoting the Development of Scientific-Technical Enterpreneurship in Higher Education possess a highly qualified staff of instructors and the necessary material-technical base for the education process (primarily computer equipment). Furthermore, the principle of cofoundership followed in the creation of the university also presupposes the principle of cofinancing of the university's activities by the ministries involved. Taking into account the specific interests of these ministries, one may predict that that their financial contributions will be allocated to various spheres of activity at the university as follows:

- Russian Ministry of Education: operation and development of the educational process, material support for the professors, instructors, auxiliary personnel, and students
- Russian Ministry of Industry, Science, and Technology: scientific and scientific-methodological research in various spheres of innovation activity and development of the material-technical base of the university, especially its information networks

The educational process at the university is organized on the basis of using modern educational and information technologies, including distance learning, in the form of basic higher education, postgraduate education, and training and retraining of personnel in short- and long-term programs.

The activities of the university are aimed at meeting a wide range of targeted objectives, including

- exporting education, including to the Russian-speaking population in the Commonwealth of Independent States
- developing editorial and publishing activities to create and mass produce training methodology literature

- developing and implementing effective new teaching technologies, especially distance learning
- creating a system for regional and industry-based monitoring and forecasting of training needs for personnel to work on innovation activities in education and scientific-technical enterprises
- creating a unified training methodology database using computer networks of the higher education system and the Russian Academy of Sciences
- creating and implementing an integrated system for training personnel in scientific-technical entrepreneurship and retraining instructors for the regions

The specific goals of educational activity at the university include the following:

- organizing training for professors, instructors, and specialists from university units and scientific-research institutes; deputy rectors for research, education, and economics; and the heads of scientific organizations in the educational system in the fundamental elements and business principles of commercializing the results of creative activity
- training a new category of specialists for organizational and methodological leadership in the entire range of issues concerned with evaluating the commercial potential of scientific research and development results, searching for strategic partners, and managing intellectual property
- resolving problems of providing personnel for the entrepreneurial sector of higher educational institutions, organizing training for specialists from small technology firms and innovation structures (technoparks, innovative technology centers, technology promotion centers), heads of small firms, managers of innovation projects, and specialists in accounting, marketing, financial strategy, intellectual property matters, and so forth
- training instructors and consultants for educational institutions so that they can train other personnel in problems of innovation management, with the goal being to form professional teams in regional educational institutions who can ensure the necessary quality of education and render effective consultative support on issues of innovation management and technology commercialization
- training staff members from federal and regional executive-branch agencies in matters concerning innovation management in the educational and scientific sphere so that they can gain the knowledge they need to provide effective assistance in developing innovation activity in the education sphere at the federal and regional levels

BOX 1 Sample List of Lecture Courses at the University

Economics of the Transition Period

Civil Rights in Economic Activity

General Questions of Psychology in the Innovation Process

Business Management

Informational Structure for Continuous Training

Marketing

Systematic Legal Protection for Intellectual Property

Certification and Problems of Quality, Including Educational Quality

Fundamentals of Investing and Trading

Entrepreneurship and Security

Organization of Manufacturing and Services

International Cooperation

Public Relations

The instructional process is organized according to the following methodological, organizational, and economic principles:

Methodology

- multilevel approach to the instruction of various categories of specialists
- modular structure for instructional system
- unified methodology for instruction at all levels
- continual updating of the educational process to reflect the changing market situation and the appearance of new technologies
- instruction designed within the framework of carrying out specific innovation projects

Instructional Organization

- provision of an open educational space
- combination of group and individual forms of training
- broad utilization of outside information sources

- use of distance learning technologies and provision of consultative guidance to students at all stages of training

Economic Relations

- multiple channels of financing
- flexible price policy ensuring economic accessibility of training (in the commercial component of the educational process)
- development and implementation of new economic mechanisms to attract additional funds for tuition payments
- ability to adapt and to use flexible structures while keeping attuned to dynamically changing conditions in the external environment in order to maintain maximum efficiency

In addition to its educational endeavors, the university's basic areas of activity also include research and commerce.

The university's research unit, which is closely linked through various instructional mechanisms with the educational unit, aims to address the following key objectives:

- conducting research and providing scientific-methodological guidance regarding processes of economic growth-oriented production restructuring, personnel training (for managers, etc.), questions of product and service certification, protection of intellectual property, and the organization and conduct of information technology upgrades and expert quality reviews of scientific-technical and financial-economic matters
- systematically analyzing and modeling aspects involved in business management
- carrying out basic functions to ensure practical mastery and consolidation of knowledge gained by students
- performing development work to provide the necessary support for the educational process and ensure continual improvements in the qualifications of instructors at the university

The commercial unit is not only oriented to attracting additional financing for the university's fundamental types of activity. It also serves as a sort of test facility for the practical implementation of the results of educational and scientific discoveries made by university staff members.

Thus, all three interrelated units function in close interaction, harmoniously augmenting and stimulating each other's development.

The following departments and institutes are currently operating at the university:

- Department of Information Systems

- Department of Applied Informatics
- Department of Quality Management
- Department of Innovation Activity in Small Business and Entrepreneurship
- Department of Economics of Innovations
- Institute of Technology Commercialization
- Institute of Legal Problems of Innovation Processes and Entrepreneurship

Consideration is being given to the possibility of opening an Institute of Training and Retraining for specialists in the aerospace industry, as well as new branches of the university in the cities of St. Petersburg, Kazan, Togliatti, Perm, and others.

In January 2001 the first group of students was admitted to the university as a result of transfers from other higher educational institutions. Beginning with their second semester at the university, these 25 students will be trained in the specialty of Quality Management.

In July 2001 the first regular incoming class (250 students) was selected for training in the following specialties:

Moscow (Including the Zelenograd Campus)

- Applied Informatics (in Economics) 50 students
- Information Systems and Technologies 25 students
- Quality Management 25 students

Penza Campus

- Applied Informatics (in Economics) 25 students
- Applied Informatics (in Services) 25 students
- Information Systems and Technologies 25 students
- Service 25 students

Northern Campus (Novgorod)

- Quality Management 25 students
- Personnel Management 25 students

On the whole, creation of the Russian State University of Innovation Technologies and Business

- represents a necessary stage in dealing with a major national economic issue that affects all industries, namely the formation in Russia of a

multilevel system for training managers for innovation activity in the scientific-technical and industrial spheres

- makes it possible to concentrate and more effectively use federal budget funds managed by the founding ministries for personnel training, development of innovation activity, and implementation of top-priority elements of socioeconomic policy.

Challenges at the Zelenograd Technopark

Vladimir Leontyev [*]
Zelenograd Science and Technology Park

Historically the city of Zelenograd has been the center of the Russian electronics engineering industry. A great number of large electronics industry enterprises are concentrated in the city, and small business in the scientific-technical sphere is actively developing under the current market conditions. More than 500 small high-tech businesses are currently operating in Zelenograd, with their activities focusing on the creation and production of high-tech products in advanced areas of modern science and engineering.

The rapid development of high-tech business created a need for appropriate support structures. In response to this need, a well-developed infrastructure for innovation has been created on the basis of the Moscow State Institute of Electronics Engineering (Technical University) (MIEE). This infrastructure includes all the necessary elements of support for high-tech business: the Zelenograd Science and Technology Park, the "Technological Center" State Research Center, the Fund for the Support of Scientific Research and Business, a nongovernmental fund for research and development work, and an investment company. A venture capital fund is also being organized.

The innovation structure that has been created provides support throughout all stages of the process of creating new scientific-technical products: from the ideas of the scientist to the mass production of finished products.

[*] Translated from the Russian by Kelly Robbins.

- The research unit of MIEE organizes basic and applied scientific research by scientists in university departments and scientific labs.
- The "Technological Center" State Research Center carries out applied research and development and produces experimental samples and test batches of innovative items.
- The Innovation Center for New Technologies is engaged in introducing new scientific-technical products into production.
- The Proton Experimental Plant manufactures products based on development work done by small scientific-technical firms and scientific collectives from MIEE.

The innovation structure also includes elements that help to translate scientific ideas into the manufacture of scientific-technical products by small business enterprises operating under market conditions.

- The Zelenograd Science and Technology Park provides infrastructure, methodology, and information support predominantly to newly created scientific-technical firms.
- The Zelenograd Innovative Technology Center creates conditions for increasing output volumes of innovative products by developed scientific-technical companies of the region by means of providing an innovation infrastructure and financial and consulting support.
- The small- and medium-sized scientific-technical firms cooperating with the technopark and the innovative technology center serve as the sources of innovations and simultaneously bring these innovations to the market.

The Innovative Industrial Complex is a project-oriented coordinating body that focuses its efforts on the final stage of the innovation process, namely the organization of batch production of the most promising high-tech products.

The following organizations provide efficient financial support for innovation projects:

- MIEE Fund for Support of Scientific Research and Business
- local office of the Fund to Promote the Development of Small Enterprises in the Scientific-Technical Sphere
- nongovernmental Fund for Research and Development

THE ZELENOGRAD SCIENCE AND TECHNOLOGY PARK: FOUNDER OF INNOVATION ACTIVITY IN ZELENOGRAD

The Zelenograd Science and Technology Park (ZSTP) has served as the initiator in developing tools to support innovation activity in Zeleno-

grad. It was officially registered in June 1991 as an association of Zelenograd enterprises. The founders of the park were the Moscow State Institute of Electronics Engineering (Technical University) and a number of state enterprises in the city.

Being one of the first science parks in Russia, ZSTP has shaped its activities by looking to the experience of foreign technoparks, analyzing problems that have arisen, and searching for ways of resolving them.

During the nine years of its existence, the Zelenograd Science and Technology Park has devoted its primary attention to developing and improving the service sphere for small firms working in the scientific-technical field. ZSTP managers have regularly studied demand in the high-tech business services market and have conducted targeted efforts to create and develop markets for new services. ZSTP has accumulated a great deal of experience in the field of consulting for small innovative enterprises. During this time, ZSTP has carried out several major international projects in which consultations for the staffs of high-tech companies played an important role. In the course of implementing projects for the British government's Know-How Fund, the European Bank for Reconstruction and Development, the European Union's Tacis program, the U.S. Agency for International Development, and the Eurasia Foundation, dozens of foreign high-tech business experts and specialists were involved and actively cooperated with ZSTP. Working jointly with ZSTP managers, they have conducted a considerable number of consultations and seminars on the most urgent problems facing small business. Moreover, all of this work was of a regular and not episodic nature—that is, the time periods of various separate projects overlapped, and foreign experts worked at ZSTP for periods ranging from several weeks to several months to a year or more.

Nine years of work have built an effective infrastructure for innovative business, and considerable experience has been accumulated regarding the commercialization of scientific-technical developments and the promotion of firms' products on the Russian and foreign markets.

ZELENOGRAD INNOVATIVE TECHNOLOGY CENTER: KEY ELEMENT IN THE TECHNOLOGY COMMERCIALIZATION PROCESS

The Zelenograd Innovative Technology Center (ZITC) was established in 1998 within the framework of the Interagency Program for Activation of Innovation Activity in the Scientific-Technical Sphere in Russia. ZITC is now the best developed and most promising innovative technology center in Russia. In this regard, the existence of an innovation infrastructure and the possibility of applying the many years of innovation experience already accumulated by existing institutions in this field have been decisive factors in the rapid establishment of ZITC.

The main task of ZITC is to develop innovation activity in Zelenograd Region by providing comprehensive support for small business in the scientific-technical sphere. ZITC is responsible for facilitating the technology commercialization process by supporting innovation projects involving the creation of market-oriented competitive products, with such assistance being provided primarily to develop scientific-technical companies. The center's work also promotes heightened engineering and scientific-technical standards as well as the growth of production and sales volumes at the firms it assists. The activity of ZITC has attracted the attention of small high-tech firms, and at present, cooperation has been established with more than 80 companies in the region. Of these firms, 37 percent are devoted to information systems technologies, 27 percent to instrument making, 22 percent to software development, and 14 percent to telecommunications systems.

THE INNOVATIVE-INDUSTRIAL COMPLEX

The creation of the Innovative-Industrial Complex (IIC) was the logical next step in the further development of structures for the support of innovative business. IIC consists of MIEE, including its structural subunits, the Proton Experimental Plant, the "Technological Center" State Research Center, the Zelenograd Innovative Technology Center, the Innovation Center for New Technologies, the Zelenograd Science and Technology Park, the MIEE Fund for Support of Scientific Research and Business, and small and medium-sized scientific-technical firms of the region.

The organizational structure of IIC is project-oriented in nature. Participants join forces to carry out specific innovation projects on the basis of standard partnership agreements (joint cooperation). Such a way of organizing relations makes it possible to take the interests of participants into account more fully. It also provides flexibility for the participation of various parties at different stages of IIC's activities and promotes unconditional fulfillment of the joint commitments made by participants during the execution of specific projects.

Within the framework of the Innovative-Industrial Complex and with the direct participation of ZITC, a well-developed research and production infrastructure has been created, helping to move the results of MIEE scientific research into actual production and providing comprehensive support to the high-tech companies of Zelenograd. In 1998, 1,500 square meters of research and production space was finished in the new building of the Innovation Center for New Technologies. During implementation of IIC innovation projects in 2000, 800 square meters of production space was put into service at the Proton Experimental Plant, and a new building with 4,200 square meters of space was completed at the Zelenograd Inno-

vative Technology Center. This building currently houses 11 leading Zelenograd scientific-technical companies.

One result of the development and improvement of the IIC infrastructure has been the dynamic growth of the high-tech companies (see Figure 1), which confirms the great significance and effectiveness of comprehensive structures for the support of high-tech small business.

THE CONCEPT OF CREATING A TECHNOLOGICAL VILLAGE

World experience shows that during the process of creating a scientific-technical product, it is best to use a comprehensive approach in dealing with the indivisible process moving from scientific ideas to the production and sale of created products under market conditions. Each stage in the product creation process should receive comprehensive support—intellectual, financial, and infrastructural.

From the standpoint of foreign practice, the optimum model for such an approach involves creating and developing a network of innovative technology complexes. Such complexes have long existed in many developed countries of Europe and America and are being developed successfully in China.

The direct task of innovative technology complexes lies in creating the most favorable conditions for innovative firms at all stages of the scientific-technical product creation chain, including complete intellectual and infrastructural support, mechanisms for multichannel financing (including venture capital), and marketing support.

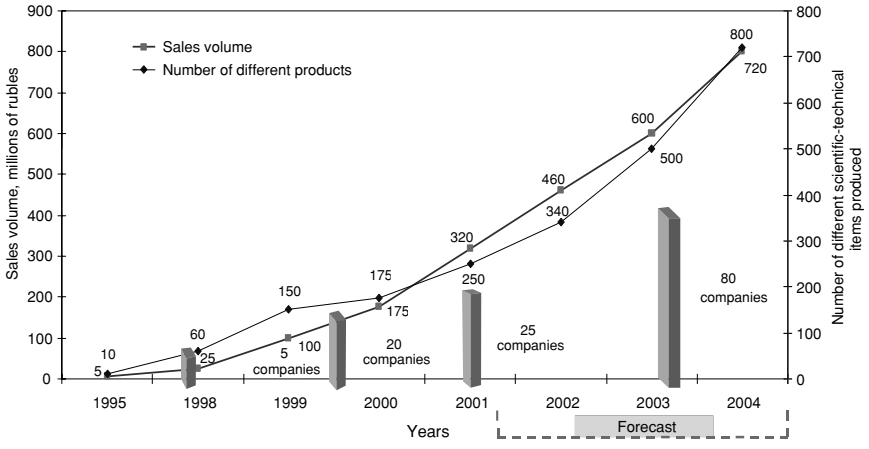

FIGURE 1 Dynamics of business indicators for scientific-technical companies at the innovative-industrial complex.

This concept has as its goal the creation of the first such complex (technological village) in Russia on the basis of the innovative-industrial complex that has already been established in Zelenograd.

URGENT NEED TO CREATE A TECHNOLOGICAL VILLAGE ON THE BASIS OF IIC

The creation of the innovative-industrial complex was an expression of the policy of concentrating the resources of participants of the Interagency Program for Activation of Innovation Activity in the Scientific-Technical Sphere in Russia and targeting investments in the most promising innovation structures. The aim of this policy is to use positive results achieved as a model for growth to be further replicated in other regions of Russia.

A modern research and production complex has now been created and is continuing to develop. It features all the elements necessary for successful creation of scientific-technical products, including an educational unit, a powerful scientific sphere, a well-developed innovation structure, and an experimental production facility.

Thus, the infrastructure that has been formed at IIC includes all the necessary elements for the successful commercialization of scientific-technical developments and represents an optimal base on which the project for creating a technological village can be carried out.

PRECONDITIONS FOR CREATION OF A TECHNOLOGICAL VILLAGE

An analysis of IIC operations indicates the following essential preconditions determining the expediency of creating a technological village:

- The existing research and production infrastructure cannot provide support to all scientific-technical companies that need it. The process of allocating space in the Innovation Center for New Technologies and the Zelenograd Innovative Technology Center has illustrated the high demand for such infrastructural support on the part of small scientific-technical companies. At present, about 80 more scientific-technical companies in Zelenograd are in urgent need of research and production space, with each company requiring from 300 to 1,000 square meters of office and manufacturing space. Thus, taking into account only Zelenograd firms, the average need for infrastructural support in terms of additional space totals 52,000 square meters. The activities of IIC have also attracted the attention of firms from beyond Zelenograd. Contacts have been established with enterprises from Moscow and Moscow Oblast, which increases the potential need for space by approximately 35 to 40 percent.

• The small scientific-technical firms at IIC have in their arsenals a considerable number of promising innovation projects aimed at manufacturing high-tech products. However, opportunities for carrying these projects out are limited by IIC's lack of a sufficient technological base that would make it possible to manufacture products meeting the required technological standards. For successful implementation of planned innovation projects, it is necessary to apply the newest technologies in micromechanics, microelectronics, and device miniaturization—surface mounting, reverse mounting, multicrystal modules, microassemblies, and microsystems. Thus, there is an obvious need to equip and reequip the IIC technological base, which will make it possible to close the gap that is forming between the high scientific-technical level of new research developments and the insufficient technological capacities of the available equipment.

LONG-TERM PLAN FOR IIC DEVELOPMENT IN CONJUNCTION WITH THE TECHNOLOGICAL VILLAGE PROJECT

Prospects for the further development of IIC are connected with implementation of the project to create a technological village. The primary goals of the project, in accordance with existing preconditions for the development of IIC, are as follows:

• constructing and equipping new research and production buildings with a total area of 19,600 square meters to accommodate scientific-technical companies from Zelenograd and Moscow region
• creating research and production centers at IIC, providing them with modern equipment, and adapting the latest technologies in microelectronics, electronics engineering, radioelectronic cluster minimization, and micromechanics to the newly installed equipment
• providing access to the equipment and technologies of the centers to all participants in the technological village

During work on the project, four research and production buildings with a total area of 19,600 square meters will be constructed. Plans call for devoting 30 percent of the space to offices, 30 percent to laboratories, and 40 percent to manufacturing. The buildings will be provided with technological and laboratory equipment, with the exact type of equipment to be determined by the needs of the small scientific-technical firms that will be the future consumers of services in the technological village. In addition, the following research and production centers will also be formed:

Design Center for Specialized VLSIs

The design center will support the process of designing VLSI (very large scale integrated) circuits, the main components in modern micro-

electronic devices. Leading Zelenograd technological firms with the appropriate resources for designing modern VLSIs will be involved in the work of the center. Production of VLSIs based on the results of the design center's work will be implemented within the IIC framework using the technological capacities of Zelenograd industrial enterprises and foreign partners. In particular, the "Technological Center" State Research Center and industrial enterprises of Zelenograd will produce VLSIs with topological norms down to 0.5 microns. VLSIs with high topological norms (less than 0.5 microns) will be manufactured in cooperation with foreign firms having the appropriate technological resources.

The design center will operate out of facilities of the Zelenograd Innovative Technology Center using equipment from Zelenograd scientific-technical firms.

Research and Production Center for the Design and Experimental Production of Electronic Devices Using Surface and Reverse Mounting Technologies

The task of this center will be designing and initiating experimental production of new electronic devices, especially those created on the basis of VLSI circuits from the design center.

The experimental production facilities will be located in remodeled space at the Proton Experimental Plant and will handle assembly of finished products using modern production lines for surface and reverse mounting of printed circuit components for radioelectronics.

Research and Production Center for the Design and Experimental Production of Micromechanical Devices

This center will design promising microelectromechanical systems (MEMS) using modern instrumental-technological modeling equipment that has been acquired. In the initial phase the sensors, actuators, and microsystems designed are being manufactured by the "Technological Center" State Research Center of MIEE. Plans call for the subsequent creation of a pilot miniplant for manufacturing, assembling, and testing MEMS elements. Another task of the center involves creating samples of new hardware using microelectromechanical devices, specialized LSI circuits, and electronic modules and then putting them into small-scale production.

Center for Metrological Measurements

The Center for Metrological Measurements will use the latest measurement technology to test scientific-technical products, especially those

created within the operating framework of the IIC research and production centers. Inclusion of this center in the IIC structure will help to ensure the production of reliable high-quality output. The Center for Metrological Measurements will operate in space at the Proton Experimental Plant.

As new buildings are completed in the technological village, two more research and production centers will be created:

1. The Center for the Design of Miniaturized Radioelectronic Clusters and Components
2. The Center for the Design and Experimental Production of Multicrystal Modules, Microassemblies, and Microsystems

Integration of the above-mentioned research and production centers into the existing IIC technological infrastructure will make it possible to carry out all stages in the cycle of creating high-tech science-intensive products within the framework of the technological village. The research and production centers of the technological village will be accessible to collectives from the scientific labs of MIEE and the scientific-technical companies on a collective access regime. In this way, the high-tech equipment will be efficiently used, which will make it possible to use the latest technologies at acceptable prices in the process of creating and test producing scientific-technical products.

CONCLUSION

The Innovative-Industrial Complex in Zelenograd is objectively recognized as the most promising in Russia with respect to the possibilities it offers for building a working model for the innovation complex of the future. This action would represent the formation of a qualitatively new system of innovation support in the revival of the Russian economy.

The technological village being created under IIC auspices will become a center for the generation of innovation programs, a unique test site for trying the latest engineering solutions and testing, certifying, and subsequently mass producing the equipment that will be created. The village will make it possible to provide infrastructural support in the implementation of comprehensive innovation programs aimed at creating competitive high-tech products.

The high level of intellectual potential in Zelenograd together with the capacities of the structure that has been created will facilitate implementation of programs of federal significance in the fields of electronics engineering, instrument making, new information technologies, and telecommunications.

States' Efforts in Small Business Development: Two Models

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Depending on the diversity of the existing business base, states have set different goals and approaches to economic development in the high-tech area. Two models are presented herein—one from Nevada, which tends to emphasize the importation of businesses from areas outside the state, and the other from North Carolina, which emphasizes the seeding and nurturing of new high-tech businesses from within the state.

Historically, the various economic development authorities in the State of Nevada have had only minimal success in promoting the immigration of advanced technology companies or the growth of existing or new advanced technology companies from within the state. For example, of the 78 new enterprises for FY2000 for which origin data is available at the Nevada Commission on Economic Development (*www.expand2nevada.com/companies/recent.html*), 67 originated outside the state. Also of note, of the total of 98 new enterprises, 47 are in manufacturing and only 1 is in R&D. The other new businesses are in either the service or the distribution sectors.

Only as recently as 1991 did Nevada seriously undertake to pool the resources of the university system, state government, and private industry. A visionary group of Nevada leaders, in recognition of the need to diversify the state's economy and build on emerging university-based technology, formed Nevada Industry Science Engineering and Technology (NISET) to lead this effort. The organization served to create an environment that was politically and economically attractive to the technology-based businesses and strove to assist the regional development agencies in attracting them to Nevada. In that same time frame, the uni-

versity system initiated an effort to develop and implement an intellectual property policy and a technology transfer program.

As background, several years ago most technology in Nevada was associated with the federal government, i.e., with the Nevada Test Site or the Department of Defense or with the University of Nevada System. Because of the nature of the business and security concerns, the operation of the Nevada Test Site has essentially been a closed industry and now, with the exception of activities at Yucca Mountain and its use as a geological repository, it is a nongrowth industry with little opportunity for the development of spin-off companies. The main industry in Nevada now is gaming and tourism, and diversification, which was not attractive to the casinos in the past, is now considered essential to the sustainability of the gaming and tourism industry.

Small companies in Nevada are the backbone of the business development community. For example, 40 percent of the new businesses in Clark County, Nevada (the county that includes the city of Las Vegas) have four employees or fewer; nearly 20 percent have 5 to 9 employees and almost 13 percent have from 10 to 19 employees. By contrast, only 0.3 percent of the businesses in Clark County have 1,000 or more employees, and 0.2 percent have from 500 to 999 employees.

More generally, the common characteristics of most state technology development programs beginning in the early 1980s include the creation of tripartite linkages between state economic development agencies, universities, and private industry; a recognition of the importance of technology development as a key ingredient of economic renewal and diversity; and a significant investment of funds. Matching funding, however, is typically required either from federal, state, or private sources.

Differences in these programs tended to be more numerous. Some of the more significant differences were the degree to which basic or applied research is emphasized; the nature of the relationship and degree of private sector involvement; the manner in which state funds are distributed; and the degree of accountability that is applied to the programs.

In 1983 the North Carolina State Legislature established the Technology Development Authority (NCTDA) (*www.nctda.com*) to create jobs and wealth throughout the state and gave it authority to establish incubators to transfer technologies into commercial applications by private industry. Since then the NCTDA has expanded its offerings to effectively provide and connect entrepreneurs through business incubation, venture capital, technology transfer, rural initiatives, and entrepreneurial expertise to commercialize promising business opportunities.

The incubators typically provide office and laboratory space, consultant expertise, an administrative infrastructure, and Internet access. The goal, of course, is to graduate, and the incubators provide incentives by

setting terms for tenure and by periodically raising the charges for rent and support.

The documented return on investment for the NCTDA indicates that

- There are now 27 operational TDA-managed business incubators in North Carolina (and more than 800 nationwide).
- More than 50 new companies have graduated from the Research Triangle Park TDA area alone.
- The TDAs have accounted for more than 12,000 new well-paying jobs.
- During the past year, more than $5.9 million in investments was made in 33 projects.
- Over the past year, the TDA has approved nearly $600,000 in loans for rural enterprises.
- A technology development partnership has been formed with the administration of the 16 campuses of the University of North Carolina.
- There are over 700 enterprises involved in the incubators.
- Each dollar provided by the TDA (i.e., a public subsidy) has resulted in $46 in matching funds raised from other sources, mainly venture capital. According to the National Business Incubation Association (NBIA), $45 is also generated in local tax revenues for each dollar of public operating subsidy provided the incubator, clients and graduates.
- A total of $12 million in state, local, and sales taxes has been generated.
- The internal rate of return during 1996 was 39 percent.

Figure 1 shows the growth of these incubators in the State of North Carolina during the period 1985–2000. What is indicated here is that this highly proactive mode of encouraging and assisting entrepreneurs and small enterprises in North Carolina (and elsewhere in the United States) is a relatively recent activity.

Of the enterprises in the North Carolina incubators, approximately 38 percent are women-owned and about 41 percent are in a manufacturing business. There are now more than 500 graduated enterprises, of which approximately 88 percent stay within a 30-mile radius of the incubator. Those graduated enterprises have averaged over $1 million in sales. The National Business Incubation Association (*www.nbia.org/info/fact_sheet.html*) provides corroborative national statistics, i.e., member incubators report that 87 percent of all firms that graduated from their incubators are still in business and 84 percent of incubator graduates stay in their communities and continue to provide a return to their investors. More importantly, the NBIA reports that the startup firms annually increased sales by $240,000 each and added an average of 3.7 full- and part-

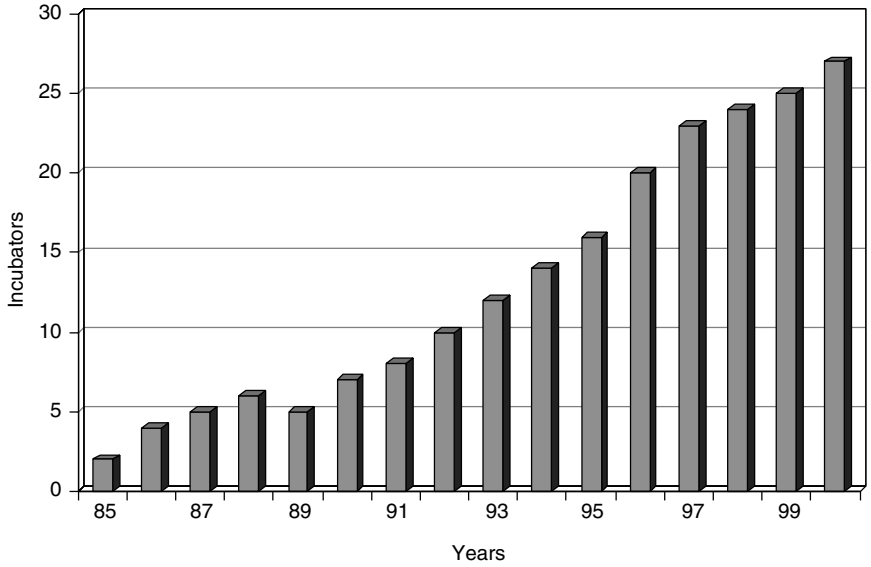

FIGURE 1 North Carolina incubators, 1985–2000.

time jobs per firm. Also, for every 50 jobs created by an incubator client, an additional 25 jobs are generated in the community.

One example of a highly innovative enterprise that graduated relatively recently from a North Carolina incubator is Blue 292. Blue 292 (*www.blue292.com/blue292/default_ns.asp*) is a business-to-business Internet exchange for environmental, health, and safety products and services. The Research Triangle Park-based company designs customized secure websites that match customers and the best suppliers of these services. It includes testing and monitoring equipment, sampling supplies, and analytical glassware, as well as staffing, training, analytical laboratory, and compliance services. Blue 292 combines market expertise with world-class technology to allow major international companies to meet the challenge of compliance in a systematic and practical manner. Their software is designed to be easily integrated into a client company's existing business system and can be tailored to meet their unique needs.

In general, in the United States, universities and nongovernmental organizations have, over the past decade or so, aggressively sought to establish an endowment to support stability and growth. According to one such example from the Entrepreneurial Development Center of North Carolina State University (NCSU), the data indicate that during the 100-year period from 1898–1998, five new enterprises were formed around NCSU technologies. The University holds an equity interest in two of

those new enterprises. During the next two years, 15 new companies were formed about NCSU technologies, and the University holds an equity position in eight of those new enterprises. Those 15 companies also caused the creation of 220 new jobs. There is, of course, a difference between the number of companies that launch a new business and the number that survive. As indicated previously, many do survive, however, and a few develop into major enterprises.

A sample highlighting the diversity of other small business development programs in North Carolina includes:

Small Business and Technology Development Center (SBTDC). The SBTDC, organized as an interinstitutional counseling and technical assistance program of the University of North Carolina, has as its mission supporting the growth and development of the state's economy by encouraging entrepreneurship, assisting in the creation and expansion of small businesses, and facilitating technology development and transfer (*www.sbtdc.org*). The SBTDC maintains 15 offices across the state and has, since its inception in 1984, provided managerial and technical assistance to thousands of new and established small business owners.

NC Biotechnology Center. The NC Biotechnology Center was established in 1981 by the State to support biotechnology research, development and commercialization statewide (*www.ncbiotech.org*). The Center assists in biotechnology startup enterprises in business development, science, and education.

MCNC. MCNC is a unique corporation that provides access to advanced electronic and information technologies and services for businesses, state and federal government agencies, and North Carolina's education communities to provide clients with a competitive advantage (*www.mcnc.org*).

The Council for Entrepreneurial Development. The CED serves the Research Triangle community of North Carolina by providing a forum for business managers to meet and exchange concepts of mutual interest. The CED also publishes a comprehensive resource directory of the organizations and agencies that provide assistance to startup enterprises. It also serves as a guide for growing a business and includes coverage of such issues as planning, financing, human resources, growth, and selling the business.

Research Triangle Park (RTP). RTP was established in 1959 by the Research Triangle Foundation, a not-for-profit organization, to stimulate the development of technology enterprises in the region. It is recognized internationally as a center for cutting-edge research and development and is now home to more than 140 enterprises with a total of approximately 42,000 employees. It also serves relocating and expanding companies that want access to technology-transfer opportunities made pos-

sible thanks to its close proximity and ties to the University of North Carolina at Chapel Hill, Duke University, and North Carolina State University.

Based on the 1990 census, records of the Small Business Administration indicate that there are a total of 159,745 *small* businesses in North Carolina (1997 data). Some 229,600 businesses of all sizes are women-owned (1999 data), and based on 1992 data, 29,221 businesses are Afro-American-owned, 3,827 are Asian-owned, and 2,802 are Hispanic-owned.

As a clear indication of sector interest, the venture capital investments during 1994–1995 in North Carolina by industry are shown in Figure 2. Almost 70 percent of those investments were in technology-related enterprises (representing 40 percent of the total number of enterprises). During this period, North Carolina had on the order of 17–20 venture capital firms with an estimated capital under management of over $375 million. The preferred size of the investments, however, was between $100,000 and $1 million.

Some of the more common barriers to new business enterprises, regardless of where they start up in the United States, include the following:

- economies of scale—deter entry by either forcing a major entry and thereby causing the new business to risk a strong reaction from the existing enterprises or forcing a smaller entry and thereby causing a cost disadvantage

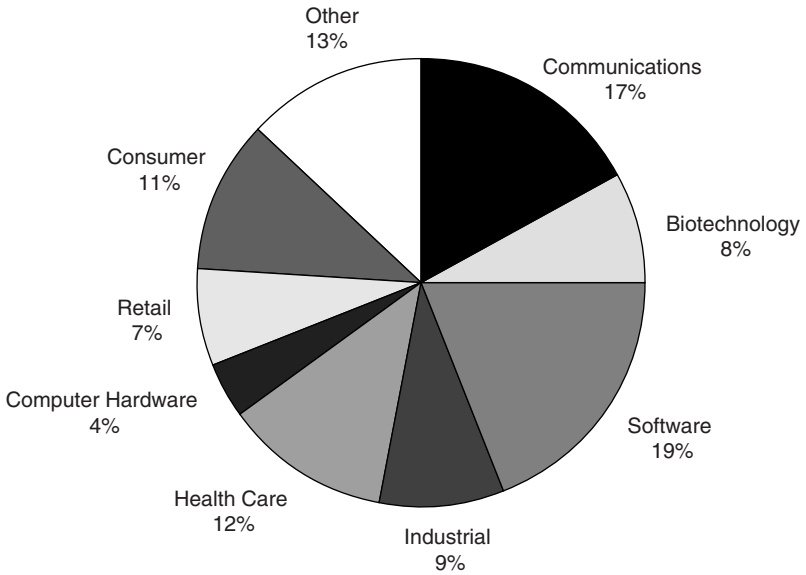

FIGURE 2 North Carolina venture capital investments by industry.

- product differentiation—forces new business to spend heavily to overcome existing competition and customer loyalties
- capital requirements—a large capital outlay is required in order to enter and compete in the market
- switching costs—expense to buyers to switch from one supplier or supplier's product to another
- access to distribution channels—the more limited the wholesale or retail channels, the more they are tied up by the competition
- cost disadvantages independent of scale—the government can limit or even foreclose the entry of a new enterprise with such controls as licensing and limits on access to critical raw materials
- expected retaliation—history of vigorous retaliation to new entrants from established firms having substantial resources with which to fight back
- government policy—established firms may have cost advantages not replicable regardless of the new business' size and economies of scale (favorable access to raw materials, favorable locations, government subsidies, learning/experience curve, proprietary product technology)

The Small Business Survival Committee (SBSC) (*www.sbsc.org*) released in July its 2001 ranking of the 50 states plus the District of Columbia according to their respective policy climates for small business and entrepreneurship. The Small Business Survival Index (SBSI), according to its author, SBSC chief economist Raymond J. Keating, "offers a gauge by which to measure and compare how government in the states treat small businesses and entrepreneurships." It manages to capture much of the governmental burdens impacting critical economic decisions. The SBSI ties together 17 major government-imposed or government-related costs (see Box 1) impacting small businesses and entrepreneurs across a broad spectrum of industries and types of businesses. Many of these are, in fact, taxes.

BOX 1 Government-Imposed or Government-Related Costs

Personal Income Taxes	Capital Gains Taxes
Corporate Income Taxes	Property Taxes
Sales Taxes	Death Taxes
Unemployment Taxes	Health Insurance Taxes
Electricity	Workers' Compensation
Crime Rates	Right to Work Status
Number of Bureaucrats	Tax Limitation Status
Internet Taxes	Gas Taxes
State Minimum Wages	

These measures are combined into one index number—the small business survival index. According to this index, the most entrepreneur-friendly state for 2001 was Nevada, with a score of 27.060. North Carolina was number 35 (score of 49.590) and the District of Columbia was number 51 (score 65.335).

The conclusion reached by the Small Business Survival Committee is that the best policy environment for entrepreneurship includes low taxes, limited government, restrained regulation, and government protection for life, limb, and property.

Figure 3 is a graphic from the NCTDA that shows the growth and development of an industry and the net benefits of that industrial devel-

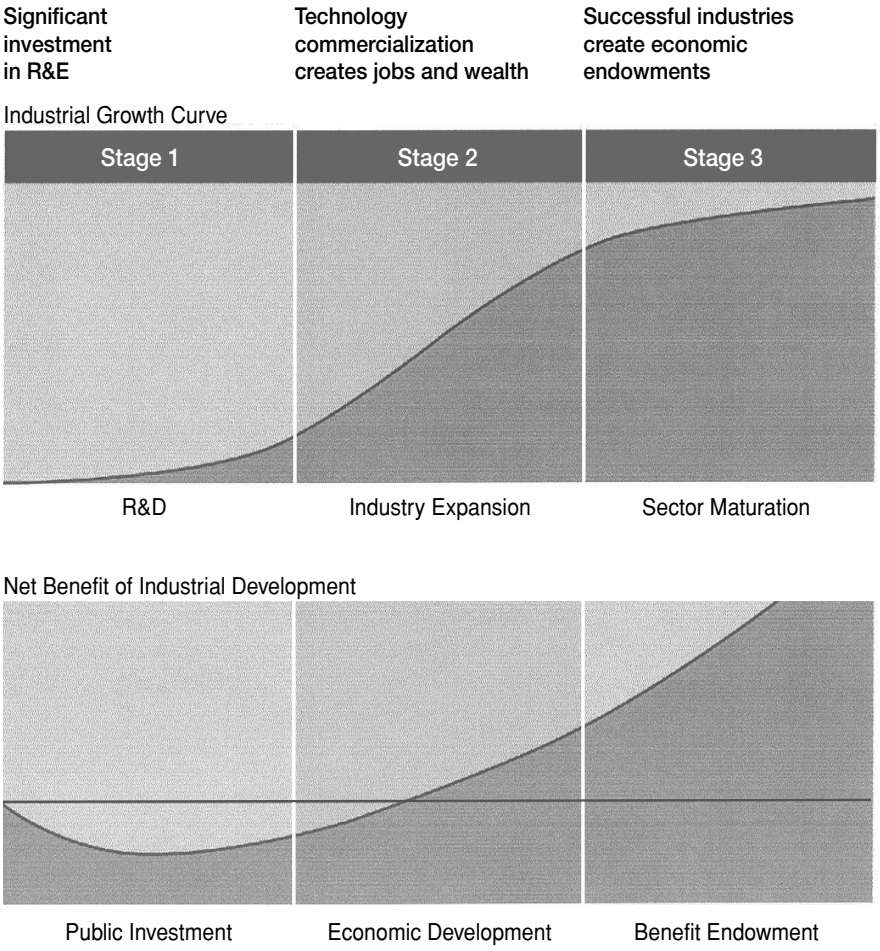

FIGURE 3 Building returns on investment.

opment. The first curve shows the magnitude of the industry as it moves through the three stages of R&D, expansion, and finally maturation. The second curve shows, in the first stage, the need for public (private and/or government) investment and actually a negative return on the investment. In the second stage the return becomes positive, and finally, in the third stage—i.e., in the sustainable growth mode—an endowment has been created. For most university and NGO research, reliance for funding (75-85 percent) is on the federal sector. The trend in these institutions was to use any discretionary R&D funds to provide seed funding for research leading to the development of a new proposal. More recently, however, the tendency is for more specific commercialization goals for any IR&D expenditures.

Finally, companies, however, rarely succeed or fail for minor or trivial reasons. The causes are usually substantial and are often self-evident, at least to an outsider. Typical reasons for failure generally include one or more key factors, i.e., that the enterprise was over-borrowed, its management was weak, the enterprise was involved in switching markets, governing or enabling laws changed, a major competitor expanded its business, or the enterprise never reinvested any of its earnings.

REFERENCE

The Council for Entrepreneurial Development, 1996. The Entrepreneur's Guide to Starting and Growing a Business in the Research Triangle. Research Triangle Park, N.C.

Development of Small Innovative Companies in Sarov to Serve the Russian Market

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This paper discusses practical experience amassed mainly since 1996 in the development of small innovative companies in the city of Sarov (formerly Arzamas-16). The city is the site of an important research and production center, the Russian Federal Nuclear Center—All-Russian Scientific-Research Institute of Experimental Physics (VNIIEF), which employs 18,000 people. Also located in Sarov is the Avangard Electromechanical Plant, employing about 3,500 people.

There is a rather high concentration of scientific and technical potential in the city, which provides favorable conditions for the development of innovation-oriented business. In terms of its potential, VNIIEF is comparable to a complex of several dozen research institutes with a fairly wide range of specialties. This facilitates the development of innovative business on many fronts, ensuring broad commercial diversification.

To provide incentive for the development of small companies, the enterprise VNIIEF-Conversion was established in 1996 on the basis of a joint decision by the Russian Minister for Atomic Energy and the Governor of Nizhny Novgorod Oblast. The founders of the enterprise were VNIIEF, the Russian Ministry of Atomic Energy (Minatom), and the governments of Nizhny Novgorod Oblast and the city of Sarov. In the years since its establishment, VNIIEF-Conversion has functioned as a business incubator, working with various partners to form small companies in different spheres of activity using attracted investments.

[*] Translated from the Russian by Kelly Robbins.

In the following text, the basic activities of the aforementioned enterprises are described briefly, including their specializations in the innovation area and the opportunities on which they have attempted to capitalize.

Employing about 120 people, Titan is a company that develops new approaches to the processing of metals and alloys. By studying the physical and chemical properties of metals and modeling the various technological processes involved, the company is attempting to create items with preestablished mechanical durability characteristics. The items are treated over different temperature and pressure ranges using vacuum technologies. The most significant results are being obtained in work with phase shift materials. About 10 patents have been obtained for research results in this area. Very interesting results have also been obtained in research on titanium alloys, materials that are currently promising not only for aviation but also for the automobile, chemical, and medical industries. The company has recently begun serial production of a number of products made from titanium and aluminum alloys. Small contracts have been signed with a number of Western European countries. In addition, the company's design group is working on original designs for road-building equipment on orders from the Russian Federation Road Foundation and is participating in various competitions and trade shows in this area.

Sarov Cellular Communications is a company that is developing and introducing mobile communications technologies in the Nizhny Novgorod area. In 1997 it completed a project to provide a cellular phone network for about 1,000 subscribers in Sarov. With its business developing in a profitable and favorably predictable manner, the company is trying to develop capabilities for manufacturing mobile communications equipment.

VNIIEF-Conversion Industry is a company that specializes in introducing new technologies in the construction industry. Its main "test site" is the southern part of Nizhny Novgorod Oblast. This particular company initiated and developed a number of new production facilities, including an asphalt plant and a mixtures plant, both of which are equipped to comply with environmental protection regulations and ensure high production standards. The enterprise is profitable and has good characteristics for further growth.

The Rehabilitation Center is an enterprise that concentrates its activities in a number of areas associated with the development of medical technologies. The main area involves the development of prophylactic and diagnostic tools, such as telemedicine. Development of efficient modern tools for medical diagnostic consultations is one of the company's most interesting problems. In collaboration with U.S. and Italian specialists, the firm is considering plans to establish a telemedicine center in Sarov under its auspices. In 2001 the enterprise opened a laparoscopy

center that performs laparoscopic surgeries in cooperation with Central Medical Facility–50 of the city of Sarov.

The Ecological Technopark is an enterprise that is developing resource-conserving technologies connected with environmental protection and accident prevention and cleanup. The focus of the company's activities in this area is currently a project on wood processing. The technological process of the enterprise, on the one hand, is waste-free and, on the other, guarantees that the products manufactured will be of high quality for the consumer. The enterprise is currently completing the investment stage, and by the end of the year, actual production will be under way at projected capacity. In addition, the enterprise manufactures small batches of specialized vehicles to order. In particular, it produced a special emergency squad vehicle based on the "Gazelle" to serve the needs of the Russian Ministry for Emergency Situations. The technopark is also preparing to produce vehicles to collect and purify sulfur hexafluoride gas, which is used as an insulator in high-voltage switches.

Imperial is a company that was founded jointly with the local church authorities to make wine.

HydroApparatus is an enterprise specializing in the production of new types of equipment for use at electric power plants, with its customers including Unified Energy Systems of Russia, among others. HydroApparatus has launched the small-scale production of hydraulic drives for electric switches.

The Testing Laboratory is a project aimed at developing special services for the testing and repair of equipment and sensors that monitor water and heat usage. In connection with the growing importance of resource conservation in Russia in recent years, a great deal of monitoring and control equipment has begun to be installed. Such equipment requires constant testing and maintenance. The implementation of this project will meet the needs for such types of services in southern Nizhny Novgorod Oblast and a number of adjoining regions.

RosBioProduct is an enterprise that is attempting to develop a unique tagging technology to meet the needs of the food industry. The company is currently in the stage of attracting investments for the project, so its products are not yet on the market.

AirUnion was established jointly with the Kazan Aviation Institute. It specializes in developing light aircraft. To date, the company has produced two series of delta-wing vehicles used in the tourism industry and in agriculture. Some of these machines have already been sold. In addition, the company is developing a small two-seat plane with a very short running distance before takeoff. Prospects for introducing such aircraft on the Russian market appear rather promising. Sarov has an airport, which provides a unique kind of test site for testing and demonstrating such aircraft.

Brilliants of Sarov is an enterprise that manufactures and sells jewelry under the auspices of a factory that processes diamonds and other precious stones.

AST is a transportation company operating in Russia and internationally.

VNIIEF-Energy is a company that develops and installs energy-saving technologies. Specifically, these include special systems for facilitating multirate operating modes for various users.

VNIIEF-Conversion Business Center is an enterprise specializing in the trading of petroleum products.

The Center for Gas Mixtures is a company that manufactures, transports, and stores special highly pure gas mixtures, in particular, for laser applications. This enterprise employs specialists from the VNIIEF laser division. Besides making highly pure gases, the company has also begun producing special tanks that ensure the stability of the gas mixtures during transportation and storage.

VNIIEF-Conversion serves as an incubator for all the aforementioned companies. It should be noted that each project is of an individual nature, with its own particular characteristics, drawbacks, and competitive advantages, and each one is at its own specific developmental stage.

Summary information on all of the above-mentioned companies is presented in Table 1.

Now I would like to discuss the history of VNIIEF-Conversion and its current operations. VNIIEF-Conversion is an open-stock company that operates as a commercial organization. If there is a real demand for an incubator in a region, such an organization may exist only in a commercial form if no governmental or municipal grants (reliable financial support) are provided. This implies that consultations would have to be on a paid basis, as would assistance to emerging companies in compiling business plans and searching for funding sources. Such an organization might pursue other commercial activities simultaneously, to support its own balance of payments. Certainly some startup capital is required at the beginning of operations. This is provided by the stockholders as a contribution to the organization's initial capitalization. Actually there are several ways in which such an organization can maintain its self-sustaining status, including

- paid consultations on business plan development. As a rule, payment is made during the project implementation stage, that is, the services are provided on credit over a set period of time.
- paid legal consultations. Typically, emerging companies employing 10 to 30 people cannot afford to keep a lawyer on staff, though they do encounter needs for legal services in the course of their operations. As a rule, all legal services to these companies are rendered by the legal group

TABLE 1 Small Innovative Companies in Sarov

Name	Market	Competitive Advantages	Difficulties	Status
Sarov Cellular Communications	Stable, regional	Developed service infrastructure	Limited nature of market	Past break-even point; now profitable
Titan	Nizhny Novgorod region, all Russia	Highly qualified specialists available	Profound market research required for correct strategy	Past investment stage; sales near to break-even
Industry	Regional and highly competitive	Highly qualified specialists available	Limited nature of market	Past break-even point; now profitable
Rehabilitation Center	Regional	Unique technologies	Solvency of the market	Embraces two projects: one is past investment stage and near break-even; the second is in the investment stage (telemedicine).
Ecological Technopark	Regional, with sales potential	New technology with good consumer qualities	Production arrangements and staffing	Past investment but not yet at break-even
Imperial	Russia	Strong competitive positions (a strong partner)	Correct product assortment policy required	Past investment and in first sales
HydroApparatus	Russia, China	Unique technology	Strong competitors, niched market	In investment stage connected with production start-up
Testing Laboratory	Regional	Licenses obtained, experienced personnel	Need to expand range of services	Investment stage; first sales expected in March 2002
RosBioProduct	Russia	Possibility to preserve technology	Uncertainty in volume of orders	Investment stage
AirUnion	Russia, International	Experienced partner	Insufficient knowledge of market	Near break-even; more investment required to develop several areas of activity

TABLE 1 (*continued*)

Name	Market	Competitive Advantages	Difficulties	Status
Brilliants of Sarov	Russia	Reliable partner: ABP	Sales and distribution system required	Investment stage
AST	Russia, International	Good base	Insufficient number of vehicles to fulfill lucrative orders	Break-even
VNIIEF-Energy	Russia	Unique technology	Insufficient commercialization of technology	Investment stage
VNIIEF-Conversion Business Center	Regional	Experienced personnel	Expansion required, lack of investments	Recoupment
Center for Gas Mixtures	Russia	Unique and reliable technologies	Sales expansion and special market research required	Investment stage; initial sales

of VNIIEF-Conversion based on a special agreement stipulating prices not higher than those of other organizations.

- consulting in accounting. A number of VNIIEF-Conversion employees serve as auditors for some companies on a paid basis.
- overhead services on fulfillment of contracts with temporary creative collectives
- operations in the stock market
- profits from shareholding in companies

On average, VNIIEF-Conversion has about 35 employees, while all the companies embraced by the incubator employ about 500 people. The experience of the incubator has shown that such an enterprise can be self-sustaining. Table 2 shows the company's annual profits, which allow it to invest in a number of other enterprises.

In 2000 an innovative technology center was established under the auspices of VNIIEF-Conversion. Its main purpose is to develop funding for investment projects using its own means and attracting funds from other sources (international foundations, state financing). In practice, it deals with developing commercial product prototypes that may be offered for market evaluation. This refers to ideas that are premature to be immediately put into production on any sort of scale, as their potential consumer qualities must first be assessed. That is, a working model must be created and the technology must be tested. This is not a matter of conducting any sort of scientific research, but rather of determining certain consumer qualities of the product using well-known technical designs and processes for that purpose. Working out all the details in this manner sometimes requires a sum on the order of $50,000 to $200,000, but this money is at high risk of producing no return. The fate of such a prototype could take one of three paths. It might be licensed to another organization, investments might be sought under the creating organization's business plan to initiate production, or the prototype might not elicit any interest whatsoever. This issue will be discussed in more detail in another presentation.

It should be noted that several new independent companies are operating and developing in Sarov, with their business being connected in particular with developing software products (e.g., the company STL, in

TABLE 2 Annual Profit Figures for VNIIEF-Conversion

Year	Profit (in rubles)
1997	2,192,000
1998	2,076,000
1999	3,142,000
2000	4,171,000

the area of computer services), equipment for the oil and gas industry, and so forth.

The experience of creating new enterprises has proven in practice the importance of the formula Management + Market + Capital. An error in one of the elements leads to a failure of the whole project. A balanced approach should be taken in upgrading all components of this system. All projects encounter essentially the same problems in their developmental stages, but they must overcome them in accordance with their specific situations. Otherwise, bankruptcy awaits them. In this regard, an incubator plays an extremely significant role in enhancing the viability of new companies in the following ways:

- consulting at flexible rates
- monitoring company activities
- providing access to additional resources

The main difficulties new companies encounter and the typical mistakes they make are as follows:

- poor knowledge of the market in which they need to sell their products
- low consumer qualities of products and, as a result, low competitiveness
- insufficient funding due to errors in business planning
- poor management
- lack of access to suitable funding sources (lack of collateral)

This point is illustrated using examples from the development histories of several companies. The key role of the project manager should be noted. Even if you have found funding and your product is long-awaited at the market, there is still no guarantee of success. "Bad" management will create a situation in which you do not have enough money, the price of your product is unacceptably high, and so on.

At present, Sarov Cellular Communications is a successfully developing company that recouped investments made in it after three years of operation. However, the early operations of the company were far from problem-free. In fact, the company was saved by the systematic independent monitoring of its activities by VNIIEF-Conversion.

This point is illustrated using the concept of net present value (NPV). Figure 1 presents the expected and actual net present value of the company.

An analysis conducted in the second half of the first year showed that costs were actually continuing to rise, in contrast to what was expected, namely that investments in the project would end and expenses and in-

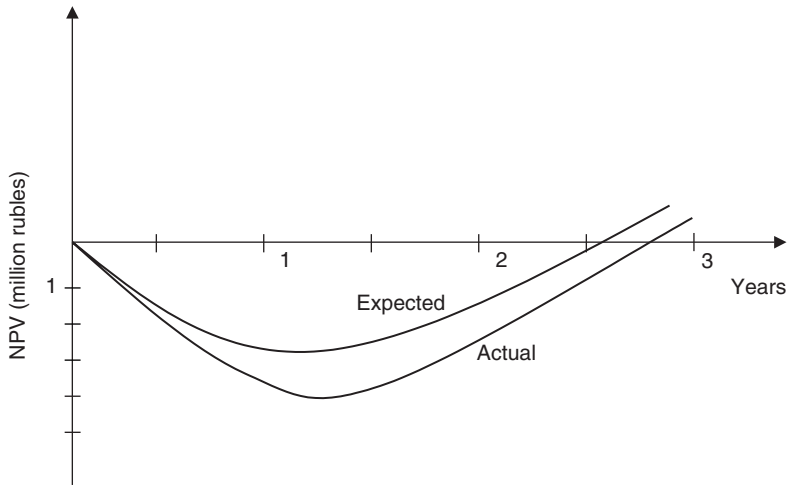

FIGURE 1 Expected and actual net present value of Sarov Cellular Communications.

come would begin to balance out thanks to sales growth. An additional loan was taken out at the bank to cover the unpredicted expenses. The analysis showed the presence of excessive personnel, unduly high salaries, and abnormal expenses for company operations (payments for contracts, services, etc.). A financial manager was appointed for a six-month term, and working jointly with VNIIEF-Conversion specialists, he developed a detailed financial plan, implementation of which was closely monitored. For example, salary costs were cut by about one-third. Income exceeded expenditures, and the company paid off the expensive loan and even returned all investments by the end of its third year of operations. Notably, this is the only mobile communications project in Russia with 100 percent Russian capital. This is a practical example of "curing" the disease of unacceptable management.

In general, difficulties in financial management are typical for small companies headed by leaders with technical backgrounds. Even a company like STL, which has such a strong partner/customer as Intel, sometimes needs consultation on tax matters.

Another difficulty associated with the required market research and financial planning arises when orders come on an irregular basis, even if a company has a strong partner. One characteristic example is a project involving the development of equipment for servicing facilities using sulfur hexafluoride gas as an isolator. The strong points of the project include the availability of personnel specializing in gas purification and the

fact that the customer is the rather well-known firm Unified Energy Systems of Russia. Because of the irregularity of the orders received, it is extremely difficult to provide for the constant operation of the production facilities, and therefore, diversification into several other commercial product lines is required. That is why the company is currently seeking opportunities for working with gas mixtures for other client companies.

Poor access to funding sources is one serious obstacle to successful business development. In the project dealing with road-laying machinery, which requires rather long-term funding due to specification processes and the related major testing program, there are a number of difficulties that are substantially slowing the pace of development efforts.

An analysis of many projects performed by the Economic Department of VNIIEF-Conversion, both within the incubator structure and on other projects, revealed that business planning mistakes connected with insufficient estimates of required funding (investment resources) manifest themselves only during the project implementation stage. Typically, mistakes involve incorrect estimations of operating capital required for marketing and product certification. In other words, such mistakes are made with regard to operating capital projections; to be more precise, usually the money turnover time is estimated incorrectly. We have encountered some projects in which operating capital was not taken into account at all. Sometimes, accounting for this factor during the course of the analysis leads to a situation in which a project may reach a point of no return on investment. Operating capital borrowed at bank interest rates leads to a negative differential in the financial lever. In a substantial number of projects, the amounts required for operating capital are even greater than those needed for equipment purchases and other capital expenses. If no help is available in the form of cheap supplemental loans, such a project may die quickly. As for the projects connected with the incubator, such a situation occurred at the Imperial company. Basically, not accounting for money required for product certification and marketing substantially transforms the project implementation process. The Titan company is to a significant extent oriented to producing goods for the Western market. The quality of the company's products and the capabilities of its plant meet Western standards. Its products have been exhibited at several trade shows in Western Europe and sales are being made through intermediaries, but the enterprise has no direct market access due to its lack of ISO-9000 quality certification. Not accounting for that factor is forcing the firm to seek additional funding in the amount of approximately 5 million rubles.

Insufficient knowledge of the target market in which the enterprise must sell its products is characteristic of practically all the new companies to a greater or lesser degree. As a result, the initial assortment of products and their prices very often differ from those stated in the business plan.

We view the making of initial sales as the main task of all projects. In fact, such sales make it possible to augment initial practical experience in the market and refine not only tactics but also, at times, even the business development strategy itself. Certainly the concept of business development should take into consideration current trends towards the shortening of product life cycles, which dictates the need to respond quickly to changing conditions. This leads to a situation in which an investment stream is required for the development of new versions of existing products. In a number of cases, profits have been insufficient to support this process or provide for effective support for new products. In particular, perforators for the oil industry are one example of a product that needs to be modernized by improving its consumer properties.

The experience gained in developing small innovative companies to serve the Russian market indicates a need for creating truly self-sustaining incubators, in order to address regional development needs. To make an innovation project successful, the following elements are necessary:

- monitoring of company activities, not only to provide a certain control over the honesty of the company director but also to facilitate analysis of the reasons for nonprofitability and to ensure that corrections are made in a timely fashion
- detailed business planning and independent expert assessment (of a real and not merely formal nature)
- access to funding sources for new business activity, as such activity involves a high degree of risk. High interest rates make it impossible to develop this sector; therefore, assistance is needed from state and international foundations.
- assistance to small businesses in developing a culture oriented toward product licensing. To that end, special protective and incentive measures should be developed.

Within the scope of their competencies, the Legislative Assembly of the Russian Federation, the Russian government, and local authorities can certainly promote the development of small innovation-oriented business in the market environment. Finally, it is worthwhile to stress two potential ways of stimulating the business development process:

1. From our perspective, tax incentives are needed for innovation-oriented business, as this will help attract private capital to this particular sphere. Primarily, this should cover value-added taxes and profits taxes.
2. State-supported innovation funds targeted to specific industries must be created and supported. This will enable the industry-based science and production sectors to play an active role in the development and practical introduction of innovative products.

Development of Small Innovative Companies in Snezhinsk to Serve the Russian Market

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During the next 10 to 15 years, trends indicate that annual economic growth rates will generally average 3.5 to 4 percent worldwide. With growth rates of 2 to 3 percent annually, as is currently the case in Russia, the country will be lagging so far behind by the year 2010 that it will be doomed to trail behind the world economy for the next millennium.

What sort of growth rate is required for the next 25 years? Russia must have 6 to 8 percent annual gross domestic product growth, and in some industries, growth rates should be 16 to 18 percent annually.

The current 2 to 3 percent growth rate has been achieved by focusing top-priority development efforts on the fuel and energy complex (raw materials sector). Small business growth will provide for an annual rate of 4 to 6 percent, but in 7 to 12 years this growth will stop due to the underdevelopment of the technological base. Enterprises will not be able to compete without new technologies. The only path to follow lies in developing the technological base by using the potential of the defense complex and small business, potential that makes it possible to commercialize new inventions and technologies.

The commercialization formula is simple:

Funds1 → Development → Commercialization → Funds2. Successful commercialization as expressed by the condition Funds2 – Funds1 > 0 is possible by pursuing the following objectives:

1. initially focusing the research process on meeting the economic and social demands of society

[*] Translated from the Russian by Kelly Robbins.

2. creating mechanisms facilitating technology transfer from the research sector to users by

- creating databases to link technical ideas and the needs of industry
- creating a network of technology brokers, namely those who can bridge the cultural gap between researchers who have something to offer and industry and government entities that need solutions to problems
- developing technoparks and incubators for entrepreneurial firms
- organizing special divisions responsible for technology transfer at universities and scientific-research centers
- providing incentives for exchanges of personnel between the scientific community and industry on joint research and development projects

Undoubtedly the problem of developing technologies and new types of products is within the powers of the major research and production centers that are equipped with the appropriate research infrastructure. This effort also requires significant financial resources. The lion's share of potentially commercializable technologies is concentrated in the defense sector, and immense resources for conversion have been targeted in this field. However, experience has shown that manufacturing new products requires not only money, but also skill in handling all aspects of bringing competitive products to the market on a tight schedule and meeting the demands of the potential customer at an acceptable price. It is this stage—commercialization—that has been practically absent. There are a number of reasons for this, primarily including the following:

- lack of motivation for companies to commercialize and market their work and a desire to obtain stable funding from the federal and municipal budgets
- the structure of such enterprises, which does not meet market demands
- weak management and lack of experience in market conditions

For these reasons, small innovative enterprises are best suited for commercialization. Obviously such enterprises must have managers who have both a technical background in the appropriate field and a fairly broad scientific outlook on the one hand and the necessary knowledge and practical skills for working under market conditions on the other.

As a rule, it is the formation of such a class of "technology brokers" that represents the main obstacle to commercialization.

The problem of developing small innovative firms is especially pressing for cities like Snezhinsk. This urgency is determined by socioeconomic development conditions in the city, namely the shortcomings in the city's infrastructure for energy, personnel, and other resources; the

lack of sufficient production facilities; and the fact that Snezhinsk is a closed city, which makes the development of full-scale production facilities inexpedient. On the other hand, the enormous scientific-technical potential of the Russian Federal Nuclear Center–All-Russian Scientific-Research Institute for Technical Physics (VNIITF), having been accumulated during more than 40 years of operation, provides a good prerequisite for the development of small innovative companies. Other important factors include the presence of highly skilled personnel, unique equipment, and a certain cultural and technical environment that has been created in the city.

EXAMPLES OF SUCCESSFUL BUSINESSES

By now a number of enterprises have amassed a certain amount of work experience in the field of commercialization. The following examples of successful activity may be cited.

The Home Closed Joint Stock Company works mainly on the production of energy-saving and heating equipment, assembly and installation of individual heating systems, and fulfillment of municipal orders in the public housing and utilities sector. It employs 19 people. In 1998 the enterprise started manufacturing Uran [Uranium] certified dual-flow heating boilers, which have heating efficiency ratings from 10 to 1,000 kW and operate on either natural gas or liquid fuel. The design for the boiler was developed by Home specialists working jointly with counterparts from the Coral Closed Joint Stock Company of Yekaterinburg. To date, an agreement has been signed with the Korean company Olympia to establish assembly production of small-power boilers from Korean components. In the field of energy conservation, Home specialists have developed and tested leakage detectors and automatic cutoff systems for natural gas utilities. But the bulk of its efforts are focused on carrying out municipal orders (production of benches, refuse bins, and fencing). This is primarily because the enterprise currently cannot operate on a commercially efficient basis solely by manufacturing the products it has developed. Its present production capacity is only one boiler per day. Therefore, Home has begun seeking investors to launch the production of heating equipment and energy-saving devices. An agreement has recently been signed with the Russian State Committee for Construction on granting a credit from the Energy Conservation Program. This loan, which is being guaranteed by the Snezhinsk City Administration, will be used to purchase $3 million worth of German equipment.

Another successful enterprise is the Bars-70 Research and Production Association, a limited liability company. The main activities of this enterprise involve developing, designing, manufacturing, and installing industrial air and gas purification equipment using electroionizing filters and

cyclones. In addition, the enterprise renders services in applying polymeric powder coatings on metal, ceramics, and glassware. It employs 16 people.

Thanks to their work experience, Bars-70 employees have in short order developed test samples of ionizing filters and tested their efficiency in practice. The sanitary-epidemiological service has recently authorized the use of these filters throughout Russia. Also, there is a license for carrying out start-up and adjustment work on gas purification equipment.

The enterprise has developed its own original ionization, power supply, and precipitation units that are unlike models currently available on the market. Bars-70 has pioneered the development of the following devices:

- a "pulsing" power supply unit with adjustable voltage making it possible to increase efficiency and ozone levels
- multistage purification systems facilitating the quick design of compact systems meeting specific customer requirements but using standard component units

To date, the enterprise has launched small-scale production of filtering equipment ranging from domestic filters to industrial ventilation systems (up to 20,000 cubic meters of purified air per hour).

Design of filters for the transportation industry is another area of activity for the firm. An air purification system for use in railroad cars has been developed. This project has been discussed with a general customer, the Tver Railroad Car Plant, and it is under consideration by the Russian Ministry of Railway Transport.

Filters produced by Bars-70 are being used at a number of enterprises in the Urals and Bashkiria and at the Chelyabinsk Oblast Sanitary-Epidemiological Station and Chelyabinsk regional hospital.

The enterprise owes the success of its activities primarily to its fortunate selection of a market niche. The company built its marketing policy on the flexibility of the equipment it produces, which makes it possible to meet the requirements of specific customers to the greatest possible extent. At present, production capacity stands at three or four filters per month. To develop production further, design new models, and move them to the marketplace, the enterprise has purchased a powder paint line for applying polymer coatings, with this service to be offered to construction, industrial, and other organizations and to the general public.

EXAMPLES OF UNSUCCESSFUL BUSINESSES

The activities of the following enterprises can be cited as unsuccessful examples.

The SnezhinskTechService Research and Production Association, a limited liability company, employs 43 people. The company's primary activity is the production of nipple watering systems for poultry farms. At the same time, it became involved in developing and producing non-invasive technical diagnostic systems for high-power transformer winding, as well as rendering diagnostic services on these devices. During their research efforts, they managed to find a technical solution that made it possible to provide qualitative evaluation of the winding press force. Pilot samples of these DIK-S2 units were produced, and some were sold. However, because of a lack of funds, all work in the diagnostic area was terminated in June 2001, and some staff members were fired. Poor management and insufficient market research were the most likely reasons for the failure. By selling equipment to the power supply systems, this enterprise deprived itself of the market for its own services. Equipment sales alone could not support the costs of this area of activity, as sales were low. This situation arose primarily because successful operation in the equipment market requires attestation and certification of the equipment, which must be then included in the official list of approved measuring devices. The enterprise needed enormous amounts of funds to meet these requirements; however, it did not take advantage of opportunities to raise funds from various federal targeted programs.

The Pulse Closed Joint-Stock Company has a staff of five. Since 1991 this enterprise has been developing and manufacturing on a piece-by-piece basis medical equipment for use in functional diagnostic consulting centers. The types of equipment produced include hardware-software complexes used in cardiographic and stationary-cycle testing, vascular examination of limbs and the brain (rheography), and a number of procedures providing for enhanced diagnostics of the cardiovascular system.

In 2000, work was initiated on the development of a new-generation 12-channel cardiorecorder for cardiodiagnostic and stationary-cycle stress-test systems and a portable 12-channel cardiograph (with capabilities for electrocardiogram [EKG] printout, storage of examination data, and data transfer via telephone line to a hospital for further analysis).

The passage of legislation on medical equipment certification and the institution of a huge number of regulations by the Ministry of Health made it impossible for uncertified medical devices to be used. The procedures involved in obtaining the necessary permits are extremely cumbersome (taking more than a year), and the costs are beyond the capabilities of small innovative companies specializing in small-scale production. Thus, the enterprise cannot sell its uncertified products to get the money needed for certification. This negatively affects the interest of potential investors, who are not ready to make long-term investments in projects that already involve a high level of future risk because they involve putting new technologies into production.

An analysis of the current situation indicates the following:

- Attempts by companies to fund commercialization at their own expense do not lead to the creation of efficient business.
- As a rule, Snezhinsk enterprises dealing in innovations do not have significant fixed assets, which makes the use of venture capital unattractive because in this case the share of founder-initiators becomes insignificantly small and in fact leads to loss of the business.
- To date the most realistic funding sources for small business in Snezhinsk are the Snezhinsk Socioeconomic Development Fund, which supports projects that enhance the socioeconomic development of Snezhinsk, and the Foundation for the Support and Development of Entrepreneurship in Snezhinsk, which funds the development of small business. However, the chances are slim for obtaining a loan for innovation activity because of the high risks and long payback terms of such projects. Almost all funds are allocated to support businesses involving the service and retail spheres or the manufacture of foodstuffs and construction materials. For instance, Bars-70 got a loan only to set up its power paint line. Thus, the innovative enterprise had to diversify its own efforts and create several divisions in its structure: some purely innovation oriented, to carry out research and development, and others production oriented, to ensure the day-to-day viability and survival of the company.
- There is a functionally complete lack of any sort of government support.
- Informational isolation is a problem. Most closed-zone companies have no access to current information, without which it is impossible to run a business in the commercialization sphere.
- Lack of management experience and knowledge, both in business and commercialization, leads to wrong decisions. In a typical case, poor research into existing legislation, particularly in the field of certification and licensing, causes subsequent failure of the commercialization effort.
- The defense enterprise around which the city of Snezhinsk is based provides almost no support to innovative companies.

In this situation, part of the above-mentioned problems can be solved by more active involvement in the various programs and initiatives aimed at developing innovation-oriented business offered through such mechanisms as the Snezhinsk International Development Center (IDC) Foundation.

The IDC is a nonprofit organization that began rendering services to organizations and members of the public in Snezhinsk on June 14, 2000. IDC's activities are funded by the U.S. government under the Nuclear Cities Initiative (NCI) program.

The main objective of the IDC is to provide support and assistance for entrepreneurial activity and the nongovernmental organization (NGO)

sector in Snezhinsk during the course of integration into the market economy.

Since the IDC began operating, 78 clients have been registered, of which 55 percent are involved in business and 45 percent work in the social sphere.

IDC's clients include state, municipal, and private enterprises and organizations, nongovernmental associations, nonprofit companies, and private persons. Organizations that play a significant role in Snezhinsk also can be found among IDC's clients, namely, the Academician E.A. Zababakhin Russian Federal Nuclear Center–All-Russian Scientific-Research Institute of Technical Physics, the Snezhinsk Physical-Technical Institute, the NGO Women of Closed Administrative-Territorial Zones, and departments of the Snezhinsk City Administration.

With the aim of effectively achieving its goals, the IDC strives to establish and strengthen partner relationships with organizations that could help promote the center's mission. To date, partner relations have been established and cooperation is under way with the Snezhinsk Socio-economic Development Fund and the Foundation for the Support and Development of Entrepreneurship in Snezhinsk, as well as with the following organizations:

- Snezhinsk City Employment Center, which provides retraining and job placement services for unemployed citizens
- LT-Resource Limited Liability Company, which provides support for investment projects carried out in the city with funding from the external sources

During the year it has been in operation, the IDC has attained certain successes in supporting Snezhinsk business.

TRAINING

Currently the IDC is the only organization in Snezhinsk that provides targeted training to assist entrepreneurs and managers in various types of activity of both a commercial and nonprofit nature. The IDC is an Authorized Training Center for Pro-Invest-IT, a company that is a Russian leader in the sphere of business planning automation. Thus, the IDC is authorized to provide basic and advanced training for specialists from various industries in financial planning and analysis, marketing, and market forecasting.

In addition to providing training using its own staff resources, the IDC has also attracted external organizations and trainers. In this regard, the IDC has actively sought seminar subjects that would interest both the business and nonprofit sectors in Snezhinsk, and it has selected instruc-

tors who could conduct the most effective seminars. Examples of such business seminars that were unanimously well received include the following:

- "Contemporary Information Technologies." Participants were acquainted with up-to-date information resources, particularly the Questel-Orbit and Lexis-Nexis systems, developed skills in creating information research scenarios to optimize search efforts, and familiarized themselves with specific operating features of Lexis-Nexis. The skills gained have allowed VNIITF employees to perform expanded searches under the Neutron Therapy public project, which is of social value for the city.
- "Efficient Sales." This 64-hour seminar was conducted by a trainer from the Stockholm School of Economics in St. Petersburg. The seminar curriculum included three units: Increasing Sales Efficiency, Business Management, and Marketing. The methods suggested have been successfully tested in practice.

Above all, the IDC is an active participant in the Snezhinsk Employment Program. In accordance with a partnership agreement signed with the Snezhinsk City Employment Center, the IDC regularly conducts courses on basic computer skills and seminars on the legal basics of business. A total of 32 people have received training under this program.

Overall, 38 seminars, courses, and training sessions have been arranged by the IDC since it began operations, with 20 of the activities being led by instructors from the IDC staff. As a result, 395 people have received training. Over the next year the IDC plans to expand the number of regular seminars on such subjects as management, marketing, and computer-aided design/computer-aided manufacturing (CAD/CAM) and to continue organizing seminars with external trainers on such subjects as certification and licensing, contemporary information technologies, and applied marketing.

SERVICES

The day-to-day work of IDC involves providing services to support and develop business and the nonprofit sector in Snezhinsk. The center provides business administration capabilities that are often unavailable to entrepreneurs and managers of conversion-oriented production facilities and public works projects. Since its establishment the IDC has rendered services in about 3,000 cases.

Consulting activity is one of the most efficient contributions in support of project managers in various fields. The center has all the necessary prerequisites for such activity at its disposal. The IDC staff includes specialist practitioners in the law, accountancy, economic and finance, sci-

ence and technology, and humanitarian fields. All IDC employees are university graduates, and two have doctorate degrees. The following types of consulting services are provided:

- onetime consultations
- consulting during project development
- informational searches for clients or partners
- conclusions and recommendations on various aspects of projects

In the course of this type of activity, the IDC has carried out four market research studies and prepared four business plans, six feasibility studies, and three proposals to the International Science and Technology Center (ISTC). The IDC has invested in and organized a new enterprise that produces wall and paving stones. To date, this project has resulted in the creation of two new jobs. Consulting and expert support has been provided at all stages of implementation of this project. With technical support from IDC, Bars-70 has won a tender and received an order for the development and delivery of air-purification systems for zinc-plating lines at the Thermoantikov company in the city of Ufa.

IDC's plans for the current year include

- arranging foreign language courses on a continual regularly scheduled basis
- creating an information center that will include an electronic library of databases on various fields of activity and will provide access to world databases via the Internet
- implementing the Open Design Bureau project to provide enterprises engaged in developing and producing complex new products with opportunities to work with up-to-date CAD/CAM software, search for orders for design work, and improve the professional skills of designers working on civilian projects

INTERNATIONAL ACTIVITY

The international activity of the IDC has been focused on supporting American NCI participants and the Snezhinsk business and social sector in enhancing mutual understanding, expanding contacts in search of potential partners, and disseminating information on various programs in the spheres of business, education, and public affairs.

In this regard, the IDC has provided the American and Russian sides with operative and reliable information on joint activities, prepared reference materials and reports at the request of organizations participating in NCI programs, helped arrange and stage visits by American delegations, and participated in various other Russian-American activities.

The IDC initiated the inclusion of four projects developed by Snezhinsk enterprises in the Accelerated Conversion Plan for the city that was prepared under the NCI program. During the visit of an American delegation in November 2000, the center arranged a tour of enterprises included in the plan for Ronald Nesse, senior project manager at the Pacific-Northwest National Laboratory, who is a member of the IDC Board of Trustees. Onsite meetings with senior managers of the enterprises familiarized Nesse with Snezhinsk business achievements and allowed him to make a more realistic evaluation of the current situation.

IDC INITIATIVES

To increase the efficiency of its efforts aimed at developing a favorable socioeconomic climate, the IDC has undertaken a number of initiatives.

The center has developed and arranged its own website: *www.snezhinsk.ru/idc*. The website is available in both Russian and English and includes all basic information about the IDC's activities. The site also provides informational resources to assist business and social programs, including announcements of grant programs, plans for IDC activities, and Internet resources (exhibitions, customs legislation, patent and information systems, joint programs). The website is frequently updated, thus providing operative information for users.

The IDC has arranged a number of activities aimed at supporting Snezhinsk business and science-technical projects, including the following:

- The IDC organized and cofunded (with the Snezhinsk City Administration) the participation of Snezhinsk enterprises in the exhibition High Technologies of the Defense Complex—2001, which took place in Moscow at the Expocenter on Krasnaya Presnya. More than 300 enterprises from 22 Russian regions and NIS countries took part in the exhibition. The closed zones were represented by two cities, Snezhinsk and Tryokhgorny. Six enterprises represented Snezhinsk: the Avangard Research and Production Association, Home, Bars-70, SnezhinskTechService, the Spectrum-Conversion Research and Production Association, and VNIITF. The status of the forum was extremely high, which produced high attendance and thus gave Snezhinsk enterprises a good opportunity for efficiently addressing the problem of finding partners and customers, advertising and promoting their products, and doing related market research.
- September 24–27, 2000, the IDC held a meeting on telemedicine in conjunction with an international conference on medical research issues. The meeting allowed representatives of Snezhinsk business and conversion activities to present their projects.

Thus, the IDC is today a well-developed structure with all the resources needed for contemporary business activity. It can provide substantial assistance and facilitate efforts under various international programs as well as in all other cases of interaction with foreign partners. To this end, the IDC offers the following:

For Snezhinsk Enterprises:

- access to external information using IDC resources, including the Internet and databases on various market segments, legislation, funding sources (foundations, investment structures, etc.), possible strategic partners, equipment, and so on
- targeted training focused on support for entrepreneurs and managers in various fields of activity of both a commercial and nonprofit nature
- consulting and expert support in preparing and implementing projects
- assistance in making contacts with foreign partners
- IDC equipment and services for use in proposal preparation

For External Partners:

- contacts with Snezhinsk business
- evaluation of the attractiveness of projects and of the resources available for their implementation
- selection and preparation of project proposals in accordance with customer requirements
- continuous supervision of project preparation and implementation
- operative and reliable information on joint activities
- assistance to foreign partners in various aspects of activity
- communication facilities, office services, and other IDC resources for foreign partners while in Snezhinsk

Development of Small Innovative Companies in Zarechny to Serve the Russian Market

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Zarechny Technopolis Development Fund

This report reviews the experience of Zarechny companies involved in innovation activity. Table 1 briefly presents information on the companies to be considered.

The main focus of this report is companies that provide an infrastructure for innovation activity. This category includes the first four examples cited in Table 1. In addition, typical examples of enterprises created to carry out innovation activity (the PGS and Ekorad firms) are also covered.

URALCONVERSION

The Uralconversion enterprise was created as one of the first open joint-stock companies in the city of Zarechny. Its initiators were employees of the Sverdlovsk branch of NIKIET (Scientific-Research and Development Institute of Power Engineering) who had worked together on projects connected with materials for use in the atomic power industry. The company's founding goals included facilitating conversion of research potential, performing research studies, and putting their results into actual production. The founders of Uralconversion included a number of former Soviet scientific-research institutes and design bureaus from Moscow, Yekaterinburg, Chelyabinsk, Tomsk, Kazakhstan, and Ukraine that had previously been involved in working on problems connected with reactor material development, including the Sverdlovsk branch of NIKIET. In addition, the group of founders also included the Zarechny City

[*] Translated from the Russian by Kelly Robbins.

TABLE 1 Small Innovative Companies in Zarechny

Company	Founded	Type	Founders	Maximum Staff	Present Condition
Uralconversion	1992	SC	22 entities (research institutes, design bureaus, Zarechny City Administration)	27	Liquidated
Zarechny Technopolis Development Fund	1993	SC	Entities including Zarechny City Administration and private individuals	11	Consulting activity, regional development company
Agropark	1993	CC	Entities including Zarechny Technopolis Development Fund	21	Liquidated
Technopark	1993	CC	Entities including Zarechny Technopolis Development Fund	17	Offers support infrastructure for small business in Zarechny
PGS	1993	CC	Individuals and entities including Technopark	7	Monopolist in the Ural-Siberian region
Ekorad	1992	CC	Individuals	5	Liquidated

NOTE: Enterprise types are listed as SC for Stock Company or CC for Closed Stock Company.

Administration, a Yekaterinburg bank, and the Beloyarsk Atomic Power Plant.

Uralconversion essentially worked on providing engineering support for several projects involving research and development for scientific products. The main such project involved developing, creating, and implementing "clean room" technology for the radioelectronics industry. Having received this major work order, the enterprise as prime contractor distributed subcontract orders to enterprises and institutions, with top priority in this subcontracting process going to the entities that were its founders. Preparatory work on the project was completed successfully; however, at that time the Ministry of the Electrical Industry found that it had exhausted its resources for continuing the work. The project was left uncompleted. No new projects were found to provide work for the enterprise's staff. With the onset of the Russian economic crisis and the total

curtailment of practically all types of production activity, the enterprise found itself in critical condition, and its founders decided to liquidate.

The main problem the enterprise never managed to overcome was the lack of business activity in the science and technology sphere, a situation that is pervasive throughout Russia. The enterprise was unable to diversify its activities, although such attempts were repeatedly undertaken. The enterprise was also unable to enter the international market or the market for services for small businesses that were then operating in the sphere of science-intensive technologies.

ZARECHNY TECHNOPOLIS DEVELOPMENT FUND

The Zarechny Technopolis Development Fund was founded in 1993 in the form of an open joint-stock company. Its creation was initiated by the Zarechny City Administration especially to work on preparing and facilitating the Zarechny City Municipal Development Program. In essence, the fund was created as an analogue of the regional development companies, the experience of which is well known. One such example is the Tennessee Valley Industrial Development Association in the United States.

The founders of the Fund include the Russian Ministry of Atomic Energy (Minatom), the government of Sverdlovsk Oblast, the Zarechny City Administration, the government of neighboring Beloyarsk Region, major Zarechny enterprises (including the Beloyarsk Atomic Power Plant and the Sverdlovsk branch of NIKIET), and the Department of Atomic Energy at the Urals Polytechnic Institute.

In accordance with its charter, the development fund engaged in preparing municipal development programs for the city of Zarechny. In so doing, it provided a citywide infrastructure promoting the modern and coordinated development of the city's social and business spheres. As a result of the fund's work, the oblast government adopted and successfully implemented the Program for the Creation of Zarechny Technopolis. Other results included the preparation and coordination with federal ministries and departments of plans for the federal targeted program entitled Creating a Regional Research and Production Complex Zarechny Technopolis, which is included in the recently adopted Program for the Development of the City of Zarechny as a Science City. To implement this program, targeted funds have been allocated from the oblast government budget, along with investment tax credit funds from the federal budget and money from nongovernmental sources.

One of the main focus areas for the Zarechny Technopolis regional industrial complex is innovation activity, not only in the science and technology sphere but also in the socioeconomic sector. To develop small business in the science and production sphere, the fund created two affili-

ated structures, Technopark and Agropark, both of which are closed joint-stock companies. More detailed information on the operating experience of these enterprises is presented below. The division of functions between these enterprises and the fund was determined by joint decision. Specifically, the fund deals with major regional development projects and works with state enterprises situated in the area. Technopark works with small- and medium-sized businesses and supports small projects in the production and scientific-technical spheres. Agropark deals with projects and enterprises connected with agricultural production and the manufacture of foodstuffs. Dividing the functions in this way has turned out successfully, at least with regard to operations involving small business.

The main problem for the fund has been ensuring the availability of material support for its ongoing activities. This is a fundamental problem for all enterprises and organizations involved in innovation activity within an infrastructural unit. The real support that was obtained for innovation activity from the federal and municipal levels had to be directed only to actual project implementation. Expenses for preparing and promoting the projects could not be financed from budgetary sources. As yet, there is still practically no demand for consulting services in this sphere. Therefore, the fund was compelled to engage in various types of side activities to make it possible to carry out its function of providing an innovation infrastructure.

The problem here lies in the constant danger that the enterprise will reorient itself toward more profitable commercial activities, leaving behind its innovation infrastructure functions. According to existing information on similar structures, the majority of them have either ceased to exist, as with Uralconversion, or are successfully operating in other more profitable fields of business.

The fund managed to overcome this problem and still manages to do so as a result of constant interaction with its founders, who have an interest in the fund as an infrastructure. This is particularly true with regard to the Zarechny City Administration, which in practice assigns the fund responsibilities for a great number of issues regarding the management of development in the city. At present the situation is improving thanks to the economic upswing as well as the new demand for consulting services in the municipal management sphere, where socioeconomic and management innovations are vitally important, and in the newly invigorated sphere of scientific-technical innovations. The fund is actively developing both of these market niches.

The second problem, which is connected with the first, is caused by the fact that the legal form of the joint-stock company is not in accord with the socially significant but essentially noncommercial nature of the work the company performs. This problem arose because at the time the fund was established, Russian legislation did not foresee such an entity as a nonprofit organization. In addition, the joint-stock company format has

some positive aspects in working with programs and with potential investors. This problem is being overcome by means of a decision of the shareholders that the fundamental goal of the enterprise is not making profit, but facilitating regional development.

The third problem lies in the shortage of personnel who are trained and capable of working in an innovation infrastructure environment. This problem is being addressed by actively searching for potentially capable young people, who will subsequently receive on-the-job training at the fund by working there as experts on a part-time basis. The Program for the Development of the City of Zarechny as a Science City includes a special Personnel Bank project to promote broader searches for promising employees.

The fourth problem involves the lack of legislation at the oblast and federal levels on matters connected with innovation-oriented development and merely development in general. These shortcomings are most acutely evident in the lack of legislation on development programs, intellectual activity, intellectual property, and rights to inventions made in the course of employment.

AGROPARK

The Agropark enterprise was created as a closed joint-stock company on the initiative of the fund to introduce new science-intensive technologies in agricultural production and foodstuff manufacturing. Its founders include a number of enterprises located in the city, including the Zarechny Technopolis Development Fund. With the help of the fund, the enterprise managed to obtain funds to create a number of new technologies and put them into actual use in the agricultural industry (the use of ozonators in the storage and processing of foodstuffs and the use of new types of equipment, for example, electric weeding devices). However, it turned out that there was insufficient demand for these technologies, and their implementation did not justify the funds invested. Attempts to diversify the activities of the enterprise were unsuccessful. As a result, the founders decided to liquidate the enterprise.

TECHNOPARK

The Technopark enterprise was created as a closed joint-stock company on the initiative of the Development Fund for the Support of Small Businesses Working with New Science-Intensive Technologies. In addition to the development fund, the founders of the enterprise included the Sverdlovsk Oblast government's Business Assistance Center and the experimental production branch of a scientific research and design institute of power engineering.

Successfully providing an infrastructure for small business and providing consulting and support services, Technopark fulfilled the functions of a municipal structure for the support of small business and took the lead in executing a program for the support of entrepreneurship. At present, Technopark continues its small business support functions taking into account its enhanced capabilities in this regard. In 2000 the city administration leased production facilities to Technopark to be used as a business incubator.

One problem encountered by Technopark during the initial stage of its operations was the insufficient volume of funds allocated in local and oblast budgets for the support of small business projects. The enterprise managed to resolve this problem by attracting funds from various, mainly nongovernmental, sources. A local bank and the local office of the Employment Fund were successfully recruited to participate in the specially prepared small business support program, and grants were also obtained to fund the program.

The second problem involved a lack of projects concerning production, especially science-intensive production. To resolve this problem, Technopark worked with the development fund to launch a special effort to seek out and develop promising ideas. In essence, these actions were taken in strict accordance with generally recognized venture capital procedures. One example of a successful venture process is a project for creating an enterprise to manufacture test gas mixtures. The project has been taken from the idea stage to full implementation now that the PGS enterprise is operating successfully and producing a profit.

The third problem concerned the discord between the joint-stock nature of the enterprise and the essentially noncommercial nature of its activities, just as was the case with the development fund. This problem is especially keenly felt in working with grants, which are usually awarded to nonprofit organizations. The problem was resolved by a special notation in the enterprise's charter documents stating that the fundamental goal of Technopark's activity is the development and support of small business and that the founders do not receive any profit earned, as these funds are entirely used for the company's stated goals.

PGS

The PGS enterprise was created on the initiative and under the patronage of Technopark for the manufacture of a science-intensive product, test gas mixtures. The founders of the enterprise were Technopark, the Laser Diagnostics Clean Technologies Technocenter, and a number of individuals, namely the inventors and implementers of the idea of producing such a product.

The idea of setting up such a production facility was born among Technocenter personnel who were working on problems connected with radiation-oriented materials science. The idea received the support of Technocenter management, but because of a lack of willingness to expand the effort, the idea was proposed for implementation on a venture capital basis at Technopark. Thanks to the efforts of Technopark, the idea was developed into a project, an enterprise was created, loans were secured to support its operations, and a project manager and staff were assembled. In its initial phase the enterprise received assistance in the form of administrative and accounting services.

Today the enterprise has a monopoly on the production of test gas mixtures in the Ural-Siberian region.

The enterprise's main problem was effective management oriented to the needs of the specific market. This problem was resolved by the selection of a trained Technopark staff member to become director of the enterprise and by his thorough preparation, including a period of study in the United States.

The second problem that arose during the most difficult period of the economic collapse was the failure of customers to pay for the products they purchased from the enterprise. The problem was solved by establishing a system of surrogate means of payment (promissory notes) and by actively working to gain the greatest possible number of customers so as to require the least possible amount of payments in monetary form.

The third problem is connected with contradictions between shareholders and managers of the enterprise regarding the targeted spending of profits earned. This problem has not been resolved. Moreover, the conflicts caused the managers to reregister the enterprise, and, as a result, the production facilities have essentially changed ownership.

EKORAD

The Ekorad enterprise was created on the initiative of employees of the Sverdlovsk branch of NIKIET as a closed joint-stock company for the development and manufacture of standard samples used for checking analytical instruments and monitoring the environment. The project participants were individuals involved in manufacturing such samples at NIKIET and workers from the All-Russian Scientific-Research Institute of Metrology and Standard Samples (VNIIMSO) who were engaged in developing standards and standard samples. The enterprise successfully began production of one type of standard sample with the support of the Sverdlovsk branch of NIKIET and VNIIMSO, which had an interest in such products. However, Ekorad was unsuccessful in launching full-scale production. Its losses accumulated, and the enterprise closed down. The

reason for the failure and the main problem was the lack of a trained manager who could organize production efficiently and produce specific science-intensive products.

CONCLUSIONS

An analysis of the experience of these and other enterprises makes it possible to draw conclusions on fundamental prospects for innovation activity and, in particular, venture capital activity under current Russian conditions. However, the specifics of this sphere superimpose particular conditions on organizational structures for the support of innovation and venture capital activity. It must be kept in mind that Russia completely lacks the innovation infrastructure that traditionally exists in the West. There are no venture capital funds. Such activity is prohibited for the pension fund. Banks do not engage in such activity because of the lack of the necessary normative documents.

At the same time, a potential for such efforts does exist in the form of the scientific and technological developments that have been achieved at research institutes and universities. Potential investors have recently begun to appear; but to link these and other necessary elements, it is essential that raw ideas be developed into projects that are acceptable to investors. It is this work that is most required to add impetus to innovation processes.

The function of developing ideas into full-fledged projects can only be carried out by specialized enterprises organized along the lines of venture capital funds. These enterprises must have connections and work experience in science and technology, and at the same time they must have experience working in business and interacting with investors. Only in this case will we see the formation of the only productive structure for the venture capital triangle (author of idea→enterprise supporting technology→venture capital enterprise) or venture rectangle (author→enterprise supporting technology→investor→venture capital enterprise).

In cooperation with the Sverdlovsk branch of NIKIET and with institutes of the Urals Branch of the Russian Academy of Sciences, the development fund is currently working to establish venture capital procedures. Protocols have been signed with each partner regarding joint actions on the commercialization of ideas and scientific-technical developments not used by institutes in their primary activities. The institutes submit to the fund specially selected ideas of their employee-inventors, which are then developed into project form by the fund in collaboration with the inventors themselves. During this process, additional scientific and technological studies are conducted, the potential market for the product is researched, a business plan for the project is prepared, and investors are sought. Then, depending on needs and conditions, the project is either

transferred to a third party for implementation (in the mode of selling a business) or is carried out by the inventors themselves with the support of the fund and the institute. To increase the scale of these efforts, plans for financing the Project for Creation of a Regional Innovation Center are included in the draft Program for the Development of the City of Zarechny as a Science City.

To make activities in this area more successful, the oblast needs to pass a law on innovation activity and establish a program for the development of innovation activity, including the creation of venture capital centers to provide an infrastructure for promoting innovations. Plans for such a concept of innovation activity have already been worked out, with the development fund being involved in this effort.

At the federal level, a package of legislation is needed regarding innovations and the support they require. Drafts of such laws are at the Ministry of Industry, Science, and Technology and the State Duma. Efforts are needed to move them forward. In addition, initiating actions are necessary similar to those taken by the science ministry regarding innovative technology centers. However, it would be expedient to link such centers not with scientific institutions but rather with more flexible, active structures with more resources at their disposal. Such structures could be found in the boards of directors of Science City programs established at the time the programs are approved and their status is confirmed.

The functions of establishing an innovation center or performing the functions of such a center should be recorded as mandatory state orders for each Science City. The functions of innovation centers could also be successfully carried out by Minatom cities regardless of whether they have been accorded the status of Science Cities or not.

Development of Small Innovative Companies in Obninsk to Serve the Russian Market

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INTRODUCTION

Since 1991 an active process of new enterprise creation has been under way in Obninsk. About 6,000 firms under various forms of ownership have been created as of mid-2001. Of these, about 300 could be considered as being in the scientific-technical sphere based on various characteristics. Actually, today there are about 50 small- and medium-sized innovative enterprises operating in the market. Their fields of activity, including both development and production, vary widely: oxygen gas analyzers (Ekon Closed Joint-Stock Company), milk filters (Conversfilter Research and Production Enterprise), feed additives (Medbiopharm Research and Production Enterprise), car rear-view mirrors (Intech Limited Liability Company), information technologies (Modeling Systems Limited Liability Company), trace gas analyzers (Eridan-1 Science and Technology Center Limited Liability Company), thermal meters (Flow-Spectrum Research and Production Enterprise), pure gallium (Conversfilter), spraying technologies (Powder Spraying Center Limited Liability Company), microfiltration systems (Express-Eko Research and Production Enterprise), power electronics (EnergoElectrica Closed Joint-Stock Company), and aerosol filters for the nuclear industry (Obninsk Center for Science and Technology [OCST]). This list could be continued, but in general, the fields of activity of innovative enterprises are related to the basic areas of research of Obninsk institutes: the nuclear power industry,

[*] Translated from the Russian by Kelly Robbins.

nuclear equipment and radiation technologies, nonmetal materials technologies, ecology, medical radiology, and meteorology.

Considering the successes and difficulties of innovative enterprises, we can see that they share many common problems of regular small enterprises but also have some specific ones. As an example, let us look at the following enterprises: Ekon, Conversfilter, Intech, Eridan-1, Energo-Electrica, and OCST.

MAIN CONDITIONS FOR SUCCESS AND REASONS FOR PROBLEMS

For all the above-mentioned enterprises, the primary condition for success was a combination of competitive technologies embodied in their products and the prices at which they offered these products on the market. However, these elements represent only part of the successes enjoyed by these companies. Let us briefly analyze each enterprise individually.

First, let us look at EnergoElectrica, a closed joint-stock company that manufactures power electronics. The first reason for their success lies in their serious efforts to market their products. For about a year the enterprise operated with heavy losses, having devoted all its efforts to studying the market and searching for customers with the ability to pay. The second reason is the enormous amount of work the company devoted to developing high production standards and ensuring that its facilities were technologically well equipped, both of which are important since the enterprise is engaged in manufacturing electronic devices. However, being founded by a group of engineers, the company encountered the problem of lacking management experience in production issues. They are learning, but still mainly by their own mistakes. The next problem is the lack of qualified staff. To solve this problem, the company plans to set up a training minilaboratory with four to six computers. There they will provide highly tailored training for advanced undergraduate students from the local Institute of Nuclear and Power Engineering. In general, the enterprise is a success. They see their development prospects in the diversification of their products and the development of new and improved devices.

The second enterprise, the OCST Closed Joint-Stock Company, is more a scientific enterprise than a production one. It was founded by the city's institutes to commercialize discoveries and inventions made in the city. Now, however, OCST has established a whole production section for manufacturing pilot samples of high-tech products: aerosol filters for the nuclear industry, water purification filters, devices for disinfecting medical wastes, and feed additives for removing radionuclides from livestock and raising their productivity. The history of OCST's production section features the same successes and failures as regular innovative

enterprises. Let us look at the successful field of aerosol filter production. The reason for OCST's success is that by relying on the powerful team of researchers from the State Science Center—Institute of Physics and Power Engineering (IPPE), the enterprise could offer consumers filters that significantly exceeded currently available filters on a number of parameters. Having a research and development base, the enterprises will soon be able to offer next-generation systems. This competitive advantage, combined with its price policy, will allow the firm to be ahead of its competitors for a long time to come. This enterprise has successfully solved intellectual property questions with IPPE thanks to a special licensing agreement. The main difficulty that OCST encountered is the extremely aggressive practices of its competitors. Being unable to beat OCST on quality, they use every possible means of discrediting the firm's products in the eyes of the consumer. At present the enterprise is developing a policy of countermeasures to neutralize the actions of its competitors. Today OCST produces more filters than a number of other innovative enterprises combined. Therefore, they plan to spin off this product line into a separate enterprise; but to do this, they must first increase their standing in the Russian market.

Despite these positive notes, the enterprise also provides some examples of actions that were not completely successful, especially with regard to the production of water purification filters. Having applied advanced technology based on research to create purification systems for submarine heat exchangers, the company devoted its efforts to producing single filters for household use. However, although in general this market is quite large, the prices turned out to be too high for the average Russian customer, and the design was not completely perfected. Sales of filters for large-volume corporate use were much more successful. Hence, the enterprise is currently focusing its efforts on obtaining certification for its high-capacity filters.

The third enterprise under consideration is Conversfilter. It is a young enterprise, only one year old. It develops and manufactures milk filters. The enterprise got a successful start thanks to the financial support of OCST, one of its founders. OCST allocated some of its profits to provide a loan to the enterprise with a rate 50 percent less than that offered by the Obninsk Fund for the Support of Small Business. As a result, the enterprise could create the necessary stockpile of materials for its first months of operation. Also, OCST rented office and production space to the firm at a low rate. The company sells its product rather actively to Belarussian farms. However, the enterprise has encountered serious problems in selling its products in Russia, even though there are no similar filters on the market. In fact, Belarus has established strict standards for the purity of milk, while Russia abolished such standards back in the revolutionary period. The majority of farms do not care about the quality of the milk

they produce, as it is bought regardless of quality. Therefore, the company managers have to pursue a policy of explaining the situation to regional agricultural departments. Recently, the company has placed its hopes on the major dairies, since they have all set up their own dairy farms, and the market economy requires quality products along the entire production chain. Sample batches of filters have recently been supplied to the dairies for testing. Considering the difficulties encountered in selling its milk filters, the enterprise ties its prospects for future development to the diversification of its product line (filters for wine, oil, etc.).

The next enterprise to be considered is the Ekon Closed Joint-Stock Company, a manufacturer of hard electrolyte gas analyzers for monitoring boiler exhaust gases. Established in 1997, its customers are power, metallurgical, and oil- and gas-processing plants and glass and ceramics factories. The enterprise has relied mainly on the effective performance and quality of the devices it manufactures. Pursuing an active marketing policy, the company is slowly but surely expanding its customer base both at home and abroad. However, in export sales, the company is encountering a number of problems with customs operations. Involving external consultants is very expensive, which is why the board of directors is focusing its efforts on hiring a specialist in this area, as export shipments are increasing. Another serious problem faced by the enterprise is the shortage of production and office space and the high cost of its existing space. To solve this problem, they are studying opportunities for building facilities of their own. The constant growth of account reporting is having a negative impact on the enterprise's operations, so they are now taking measures to automate their accounting systems. Expansion of sales to Europe led to the problem of International Organization for Standardization (ISO) certification of the products. Therefore, preliminary work is under way to prepare certification agreements with licensing companies and to search for investors.

Having scientists and researchers on staff, Ekon links possibilities for its further development with a number of objectives: developing new products, improving quality and decreasing costs, expanding production, and obtaining certification of their products according to international standards to facilitate entry into foreign markets.

The last innovative enterprise to be considered is the Eridan-1 Science and Technology Center. This enterprise began work on the innovation project Trace Gas Analyzers in 1995, but these efforts especially accelerated in 1998–1999 thanks to financial support from the Sberbank savings bank, which provided targeted credits not only for export orders, but also for the entire project itself. When the first Sberbank loans were obtained, the key role was played by the Obninsk Fund for the Support of Small Business, which operates under the auspices of the city administration. The fund provided guarantees and risked its own assets for the benefit of the enterprise.

Eridan-1 is encountering significant difficulties in the further development of export activity and the implementation of the trace gas analyzer project for three reasons. First, all its loans are short term, lasting generally three to four months but no more than one year. With such short loan periods, there can be no question of long-term innovation projects or any long-term development. Second, the interest rate is rather high, so the loan can be paid back only with highly profitable projects. Third, opportunities for placing material assets as collateral are very limited.

The point is that, according to the completely justifiable demands of the commercial banks, of which Sberbank is one, a company must provide collateral in the form of an asset that could be liquidated if necessary. To produce any instruments or equipment that could be sold or given as collateral, a company needs credits to carry out all the work necessary to transfer an idea or a patent into certified manufactured products—devices, equipment, or technological processes. So, the enterprise is caught in a vicious circle. The bank has no right to lend to any enterprise without collateral, and innovative enterprises most often lack it.

The lack of solid collateral often hinders the rapid development of Eridan-1. They were able to obtain loans only on the basis of the devices and equipment they owned, which were insignificant in cost, or special targeted loans for export orders under contracts with certified letters of credit. To achieve optimal growth, they need much more credit. With regard to the investment project on trace gas analyzers and other devices, which could be profitably produced and sold, the enterprise must have even more of its own assets or an independent sponsor, both of which are very difficult to find.

The problem can be solved by giving unsecured venture capital loans to innovative enterprises with a good credit history, well-founded market prospects, and good financial and staff capabilities.

However, doing this involves many difficulties. It is very hard for a small company to place its equity in a stock exchange (due to the underdeveloped stock market in Russia), and there are no serious private investors who want to get involved in this most interesting work of seeking, selecting, and supporting innovation projects. This evidently occurs because many serious investors underestimate the economic efficiency of innovation projects and their ability to bring potentially high profits.

THE MOST IMPORTANT LESSONS

In 2000–2001 an analysis of the overall status of innovation activity was conducted in four Russian cities, including Obninsk, within the framework of the Tacis Innovation Centers and Science Cities project. The study highlighted the main problems in the city that currently complicate

or hinder the commercialization of products, services, and technologies. These problems included the following:

- lack of working laws on intellectual property
- negative attitudes on commercialization among a number of research institute directors (the institutional owners of intellectual property) and the failure to focus on commercial results when conducting research and development work
- lack of specialists in the field of commercialization and other professional staff for innovative companies and projects
- insufficient entrepreneurial initiative among the authors of projects
- high financial barriers in the search for necessary facilities, equipment, and so forth
- lack of business incubators for innovative companies
- the Russian mentality (innovative companies wish to carry out their activities by themselves to the maximum possible extent)
- distrust of innovative companies in the quality of work and prices charged by innovation infrastructure enterprises
- low overall level of entrepreneurial culture

Among the problems that hinder the operation and growth of small- and medium-sized technology-based enterprises are the following:

- lack of sufficient operating capital for research and development activities, equipment upgrades, and capital construction aimed at expanding production and improving product quality
- lack of necessary office and manufacturing space
- insufficient awareness among firms of information about the innovation infrastructure in the city and its capabilities
- the high cost and not always high quality of consulting services
- unsettled issues of intellectual property

Based on a survey of small enterprises, estimates were made of the need for various services, including in the areas of technological development, business development, financial issues, information support, and start-up support. The survey indicated that only 10 services on the list were of interest to less than 25 percent of respondents: consultation on matters of selling or buying licenses, preparation of documents for privatization and postprivatization, consultation on resolving nonpayment issues, estimation of the value of property and company assets, restructuring, technology audits, consultation on technology transfer issues, consultation on securities operations and the stock market, and training on issues of crisis management and the securities market.

Table 1 shows estimated needs for services among small enterprises based on the results of a survey of 44 such firms.

TABLE 1 Needs for Services among Small Enterprises

Service	Percentage of Enterprises Needing the Service
In technological development (audit, expert review, etc.)	10
In business development:	
Product promotion	40
Market research	40
Legal support	40
Patent and licensing support	40
Business planning and investment projecting	30
Certification	50
Consultation on restructuring issues	5
Organization of advertising and public relations companies	40
Assistance in staff recruiting	40
Educational and training activity	20
In company finance:	
Promotion for external financing	70
Tax optimization	20
Consulting on arrangement of financial activity and accounting, auditing	40
Credits and preferential loans	50
In information support for innovative business:	
Databases on regulations	10
Information on standards and patents	10
Partner searches, access to information about demand and supply	50
Automation and information technologies	15
Web design and other Internet-related services	40
Organization and holding of seminars and conferences	10
At the company startup stage:	
Assistance in organizing start-up funding	100
Consultation on issues of company establishment	20
Supply of space for companies	100
Support for activities in the initial period	80
Equipment supply	50
Other activities aimed at supporting innovative companies and authors of innovation projects:	
Project management	5
Pilot production	10
Design and graphics	30
Construction and maintenance of office and manufacturing space	30
Editing and publishing	30

The survey has shown that among the most necessary services for small enterprises are the following: assistance in seeking customers and subcontractors, assistance in obtaining certification and standardization of products and services, and provision of information about the market, competitors, and potential customers. About a quarter of the companies surveyed consider the following services to be necessary for their development and are ready to pay for them: computer networks; Internet service; publishing and advertising services; provision of information about new technologies; assistance with business law and taxation issues; preparation of patent and trademark applications; organization of exhibitions, presentations, and business meetings; assistance with licensing; personnel recruitment; patent searches; and training in accounting.

Payment for other types of services is possible only with support (50 percent) either from existing funds or from city, oblast, or federal government sources.

The quantitative need of small enterprises for the services is as follows:

- low interest rate loans (10–15 percent): in the sum of up to 100 million rubles annually
- experienced specialists: up to 150 persons per year
- rental of office and manufacturing space with information infrastructure: up to 3,000 square meters

ACTIVITIES AIMED AT IMPROVING BUSINESS OPPORTUNITIES

In the opinion of innovation infrastructure specialists and the innovative companies themselves, a number of effective measures should be taken to assist in the development of high-tech business and promote the transfer of high technologies into production to earn profits in the market environment in the coming years:

- provide incentives for research and production companies that produce marketable science-intensive products that conserve state resources. To do this, it is necessary to work out criteria for tax cuts according to the marketability of the product and the economic impact of its introduction.
- institute certain incentives for the rental or purchase of production facilities and equipment, as well as incentives regarding communications and utility services
- invest in the advertising and exhibition activities of such companies
- train personnel for the innovation sphere with knowledge of effective methods for managing innovative enterprises and promoting new technologies and products to the market

- create marketing structures that could promote the most marketable products of high-tech companies and finance these structures from city and regional budgets
- create conditions under which innovative companies can receive consulting services on preferential terms. This can be done by giving subsidies to the most professional enterprises making up the innovation infrastructure of the city. For example, such subsidies could be paid from the Obninsk Science City Program.
- ensure that new commercially advantageous projects are discovered and promoted for financing
- create an effective legal mechanism for transferring new technologies from research institutions to small high-tech enterprises
- develop a mechanism for insuring the venture capital of investors, high-tech product developers, and manufacturers
- create an attractive investment climate in the city to attract outside investors.

Companies Based on Technologies Developed at U.S. National Laboratories

Alvin W. Trivelpiece
Oak Ridge National Laboratory (retired)

THE INTERNET PICTURES CORPORATION (IPIX)

In June 2000, at a meeting at the Russian Academy of Sciences, I described a small innovative company that had been started in Oak Ridge and that had grown in part out of technology that had been developed at the Oak Ridge National Laboratory.

The business is based on the idea of using wide-angle, fish-eye lenses (185 degrees) on a digital camera to obtain a hemispherical image. The image that is captured in the camera's memory can be transformed mathematically to eliminate the distortion caused by the lens. This image can then be stored in memory and displayed on a computer monitor screen in such a way that it can be viewed as if it were on the inner surface of a hemisphere.

Now imagine rotating the digital camera 180 degrees about a vertical axis through the lens plane so that a second hemispherical digital image is captured. By removing the distortion from this second image and numerically joining the two stored hemispherical images, it is possible to create a so-called 360-degree by 360-degree image. What one sees on the monitor of the computer screen can be thought of as the image you would see if you were at the center of a sphere and the image were on the inside surface of the sphere. As you would turn your head in any direction you would see what the camera recorded in that direction. This so-called bubble image (or 4π image) is a breakthrough in photography. It is a simple idea. However, by itself, it does not necessarily make a profitable business.

When I reported on the growth and successes of the Internet Pictures Corporation (iPIX) in June 2000, there was every indication that this company was going to be an outstanding commercial success. The price of the stock was about three times greater than it had been for its Initial Public Offering (IPO), and there had been several mergers with other companies that gave good market growth.

Unfortunately the stock markets in the United States started to decline shortly after June for some of the computer-based technology companies. On October 17, 2000, there was a sharp decline in technology stock prices. iPIX stock eventually sunk to a level of less than $1.00 per share from a high of $46.00. This forced iPIX to take measures to reduce its costs and sell off some of its assets. It has since undergone reorganization with a reverse stock split of 1 new share of stock for 10 shares of the original stock. This was part of the reorganization, which involved some new investors providing more than $20 million in additional capital. iPIX appears to be on the road to recovery, but that is not guaranteed.

I brought several copies of a CD-ROM disk that has iPIX images of several cultural sites in Russia. There is only time to show a few. As you can see, it is possible to look in any direction at works of art and architecture. Copies of this disk are available in the lobby of the conference center. Take one and examine the images at your leisure. You can also gain information about iPIX from the Web; its address is: *http://www.ipix.com.*

My point is not to go over the technical details of the company or technology of how the iPIX imaging system works. Rather, I believe what happened to iPIX shows how problems can arise over which the inventors and investors have no control. These kinds of nontechnical problems can cause a company to nearly fail, as in this case, or go completely out of business, as happened to many others during the recent drop in the U.S. economy.

A good idea and good backing are always necessary but almost never sufficient to ensure a successful business. Laboratories in the United States and in Russia are populated with scientists and engineers who believe that if they invent it, someone will want it. They would be better advised to find out what someone wants and then find a way to provide it.

CTI

For the participants of this workshop, it is not necessary to explain what a positron is or that it annihilates when it collides with an electron. This annihilation process results in the emission of a pair of gamma rays. It is possible to detect these gamma rays and determine the location where this annihilation took place.

Fluorine 18 is a short half-life radioactive element that emits positrons. By binding fluorine 18 to glucose and injecting a small quantity into a

human subject, it is possible to measure the metabolic activity at a particular location in the body. The injected substance is fluorodeoxyglucose (FDG), which is utilized by malignant tissue at more than three times the rate of normal tissue. The emitted gamma rays determine where the highest levels of metabolic activity are. This creates a means of determining where diseased tissue is located. This process is called Positron Emission Tomography (PET).

The company that has developed PET into a commercial product is called CTI. It is located in Knoxville, Tennessee. It is a privately held company, which is an alternative to seeking funding from shareholding investors through the stock markets. I have chosen to mention CTI at this workshop, since it illustrates that going from an excellent diagnostic tool such as PET to a practical device that can be manufactured and sold at a profit is usually a long, hard process. This company has many roots in activities that had origins at several Department of Energy national laboratories. One of its early experimental uses has been to study metabolic activity in the brain in an effort to understand the processes that lead to Alzheimer's disease. By comparing the metabolic activity in a normal brain and the abnormal metabolic activity in the brain of an individual suffering from dementia, it is possible to show that the disease causes some areas of the brain to have low metabolic activity. This does not explain the cause of dementia, but it does provide a tool that allows investigation that might lead to a cure.

CTI has a unique heritage, starting with its founding in 1983 as a privately held corporation headquartered in Knoxville, Tennessee. In January 1984, CTI acquired the emission tomography (ECAT) scanner business from EG&G ORTEC and began operations. Later that year, CTI acquired leading cyclotron personnel and technology from the Cyclotron Corporation in Berkeley, California.

CTI then received investment capital in 1985 to finance the development of a new PET scanner product line and a new RDS cyclotron. Through a reorganization in November 1986, CTI acquired the remainder of the Cyclotron Corporation (now known as CTI Cyclotron Systems).

With its products successfully completed and introduced in 1986, CTI signed a distribution agreement with Siemens for the ECAT scanners, and during 1988, CTI and Siemens executed a joint venture agreement creating CTI PET Systems, Inc. Later, Mitsui Corporation, whose ACT subsidiary produces BGO detector material for the ECAT scanners, invested in CTI, Inc. This latter investment was made in part to form CTI Services, Inc.

In the spring of 1996, CTI Services, Inc., entered into a joint venture to form P.E.T.Net Pharmaceutical Services, Inc., to accelerate the availability of PET radiopharmaceuticals for clinical diagnostic imaging. PET was selected as *Time Magazine's* Medical Invention of the Year. Why is PET better?

- PET is more accurate than most conventional imaging tests.
- PET can replace many tests with a single examination.
- PET images the whole body in a single examination.
- PET often diagnoses illnesses much earlier than conventional diagnostic procedures because PET shows altered metabolism that occurs before anatomical changes.
- PET eliminates the need for ineffective or unnecessary surgeries or treatments.
- PET significantly reduces medical costs and often eliminates unnecessary patient discomfort.

I have chosen CTI as an example of a commercial enterprise that has grown out of knowledge of science and technology, much of which was developed at national laboratories and universities. In that regard, it is the same knowledge that is well known to those of you working in Russia's nuclear cities. It was not just the knowledge of the science and technology of PET that has made CTI successful. Rather, it was the long, hard work making a device that someone would buy and use. This means gaining acceptance from the medical community, gaining approval of several federal agencies, and making a high-quality product at a low-enough cost.

The next time a delegation from Obninsk visits its sister city of Oak Ridge, it might be useful to visit CTI, which is located nearby.

SANDIA

Sandia National Laboratories in Albuquerque, New Mexico, has had several projects that have led to successful businesses based on technologies developed at its facilities. One of these developments is the subject of a 2001 report entitled "Technology Transfer from Sandia National Laboratories and Technology Commercialization by MODE/Encore" (copies may be obtained from the U.S. Department of Commerce at *http://www.ntis.gov/ordering.htm*).

This Sandia report is an excellent case study that describes what happened with a particular project involving MicroOptical Devices (MODE). It describes how the project got started, the steps that had to be taken to move it from the laboratory to a commercial activity, and the problems that occurred along the way. I recommend this report as an excellent guide on some of the activities that must be done to give an innovative small business a chance of succeeding. I am sure that any of the authors would be pleased to receive questions regarding the project or the process of commercialization.

The Creation of Sustainable Business in Russia's Nuclear Cities

Juan Matthews
Tacis Project on Innovation Centers and Science Cities

INTRODUCTION

Over the last two years, the Tacis project on Innovation Centers and Science Cities has been working with four Russian scientific cities:

Obninsk—Russia's first *Naukograd*. Obninsk is a nuclear city centered around the Institute for Physics and Power Engineering of the Ministry for Atomic Energy (Minatom), but with 15 institutes covering advanced materials, medical radiology, meteorology, radiation chemistry, agricultural ecology, and technical education.

Reutov—adjacent to Moscow on the west and home of the MashinoStroyenia Research and Production Association, developer and manufacturer of civil and military aerospace hardware. Now MashinoStroyenia is diversifying into environmental equipment and information technology.

Koltsovo—close to Akademgorodok and home to the State Research Center for Virology and Biotechnology, Vector. Vector was formerly part of Biopreparat, the state civil and military bioproduction organization, but is now an internationally recognized center for virology and a developing cluster for pharmaceuticals.

Troitsk—another nuclear city close to Moscow and home to TRINITI (Troitsk Institute for Innovative and Thermonuclear Research), the Minatom center for civil and military thermonuclear research. Troitsk also has

nine other institutes, mainly affiliated with the Russian Academy of Sciences, which are involved in a wide range of physical science work.

The Tacis project has been working with federal and regional government to develop policies on science cities, but more importantly to this conference, the major effort has been in working directly with R&D institutes and with local innovation infrastructure to develop methodologies to release the commercial potential of the science base and promote new business. Experts from the European Union, from Russian academies and consultancies, and from local organizations were used to carry out the work. About 200 local staff in institutes and innovation support centers were given training, new equipment was provided to support the innovation infrastructure, direct support on commercial development was given to six selected institutes, and nine demonstration projects were carried out on commercial development. The final result included three new joint venture companies, two nonprofit partnerships between R&D organizations and industry, and significant restructuring in three institutes to assist their commercial development. The methodology and training materials were published in Russian in a series of books produced by the project, and the material on commercial development of R&D organizations is available in HTML form and will be put on the Internet in Russian and English for free access.

SUSTAINABLE DEVELOPMENT

Sustainability may have become a somewhat clichéd expression, but it is the most important principle here. Either the nuclear cities are to survive or they are to be obliterated in a costly process of withdrawal—costly in both economic and human terms. Sustainability means finding ways that allow development to continue without long-term external support.

In real terms, sustainability means two things:

- commercial development of the intellectual property (IP) and capabilities in the cities
- flow of cash back to the infrastructure of the cities and to the institutes that generate the long-term science and technology potential

Exploitation of IP in small businesses is not all that is required to initiate and sustain innovation. A brief look at successful clusters in the United States and Europe will show that this is the case. These clusters are based on centers of science and technology education and R&D—Stanford, MIT, Oxford, Cambridge, among others—combined with good infrastructure and communications. In the West the drivers for technological development are our universities and, to a lesser extent, national

laboratories. The research laboratories of large corporations and innovation enterprises feed off the flow of ideas and staff from the universities. Constrain or close down the universities, and the whole of the scientific infrastructure will die.

The situation in Russia is different. A historical accident has resulted in the separation of university education and scientific research to a large extent. This happened before the Soviet period, but the system of separate research institutes suited the requirements of a centrally planned economy. All science cities are based on one or more state research institutes. Some of the larger science cities also have educational institutes that usually serve the requirements of the research organizations. Scientific production and services are often closely located to R&D institutes, and some R&D institutes have a primary or secondary production role. The universities are found elsewhere in Russia's large cities and have very limited scope for research; hence, both the student body and the teaching staff are isolated from the realities of industry and research.

To create sustainable business, mechanisms are needed to bring together R&D with sources of young bright staff and the generation of a body of people with the commercial skills needed to create innovation businesses. In the rest of the presentation we will look at aspects of such mechanisms.

CULTURAL CHANGE IN R&D ORGANIZATIONS

This project was preceded by a project entitled Science and Technology Development in the Russian Market Economy, which was carried out between 1995 and 1998. That project focused on the development of innovation management policies and the creation of innovation centers in four cities—Tomsk, Novosibirsk, Samara, and Zelenograd. Although the innovation centers were successfully set up, little progress was made in attracting new business from local R&D institutions. The reason for this was the poor development of commercial understanding in these institutions. Consequently the current project has devoted a lot of its time to cultural change in institutions. One of the two consortium members running the project is AEA Technology plc, a large publicly quoted technology services company created from a government R&D organization with several research centers in the United Kingdom, the UK Atomic Energy Authority. The successful creation and development of AEA Technology depended heavily on a top-down cultural change process that required the commitment of every staff member. The experience from this was invaluable in convincing directors of Russian R&D institutions of the benefits of commercialization.

The first step in working with the Russian institutes was to do an appraisal. The appraisal process was not just a technology audit but also

an in-depth understanding of the systems and culture. The method used for the appraisal was a workshop with the director and main officials of the organization at which information was collected to establish an institutional development profile covering 10 critical areas:

1. Purposes and aims (strategy)—does the institute know where it is going?
2. Leadership—is the institute led or is it administered as part of a bureaucracy?
3. External factors—is the institute to some extent controlling its destiny?
4. Culture—is the institute culture suitable for the future?
5. Capabilities—what is the status of the skills of the staff and the facilities?
6. Individual needs (motivation)—are the staff content and working well?
7. Systems—are there adequate systems in place to enable the institute to function properly?
8. Management—what is the quality of the management?
9. Structure (organizational)—is there a clear structure that is suitable for the future?
10. Commercial understanding—are there staff trained in commercial processes?

In all, 15 institutes were appraised and their directors given appraisal reports that also gave some outline indication for development priorities. The six institutes selected for participation in the full project were chosen on the basis of a range of development levels to provide a good range of models for the output of the project.

The appraisal reports were used with the selected institutes as a basis to form strategic plans and to identify the main areas for cultural change. In almost all cases the institutes were strong in capabilities, leadership, and purposes, but were all poor on commercial understanding and had a culture that was not suitable for the future in a market economy.

Producing cultural change relies on commitment from the director of the institute, and one selection criterion was the willingness of the director to participate. In looking at institutes in the cities, a number were found where it was clear the director did not want to change the culture even if funding levels were making the management of the institute impossible and even if there was pressure from management and staff for change. No institutes in this situation participated in the project. It quickly became clear that the degree of development was not to extend to privatization, but the requirement was to create an extra income flow to exploit the IP and capabilities of the institute, and that is what the project concentrated on achieving. Models of varying stages of development were

available from European experience with large publicly funded research organizations. Figure 1 below shows the stages of commercial development of government-funded R&D institutions and compares them to the development of a selection of European examples of R&D centers:

Strategic planning workshops and mentoring were used with institutes to determine the degree of commercial development required and to set actions for the program. Initially the institutes were mostly in the mission-led or market-testing stages. The task was to take them to the market-oriented stage, that is, to restructure them to introduce commercially oriented departments while retaining a state-funded R&D core. In the future the larger institutes will face the decision for further development by detaching the commercial activities or, in one case, to privatize the whole of the activities.

Cultural change was then encouraged through specific workshops to build commercial skills and attitudes. In three cases, organizational changes were carried out at this stage to reinforce the cultural change. Topics included in the cultural change program were team building, business planning, strategic marketing, negotiation skills, pricing, project management, and the management of risk. In one case where the institute was expecting a major change to be imposed on it in about 18 months, it requested a series of more detailed cultural change seminars covering the 10 topics from the original appraisal.

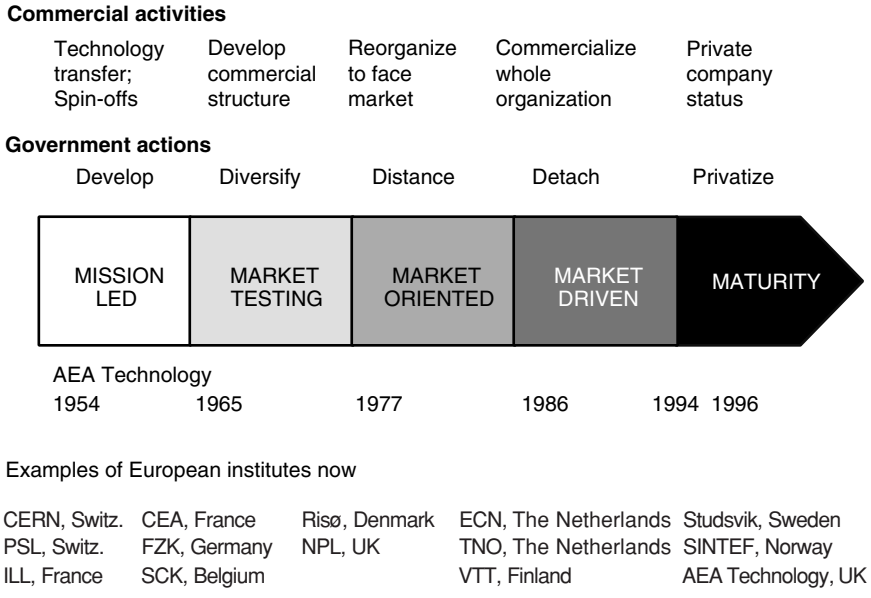

FIGURE 1 Commercial development of state-funded R&D organizations.

STRUCTURES TO PROMOTE BUSINESS

There are two requirements for market oriented R&D institutions—commercial capabilities and a structure that reflects the market. The first stage of development is the creation of a commercial department in the organization or, for larger organizations, in each division. The commercial department looks out for the needs of the customers and supplies information to the R&D, product development, and operations functions in the organization. The second stage is the restructuring of the divisional structure to match the simplest groups of customers. Restrictions on non-R&D activities in the institution often mean that management of intellectual property and operations relating to commercial contracts have to be carried out outside the institution in separate legal entities. Figure 2 shows a typical commercial structure for a medium-sized R&D organization.

This model structure shows that federal budgetary links are entirely separated from the commercial activities, except that IP developed with federal funding is used in the commercial activities. One important decision is which of the required commercial capabilities are kept in the organization and which are purchased either from the local innovation infrastructure or private consultants. Exploitation of IP can be either direct licensing or sales to a customer, exploitation in a subsidiary or a joint

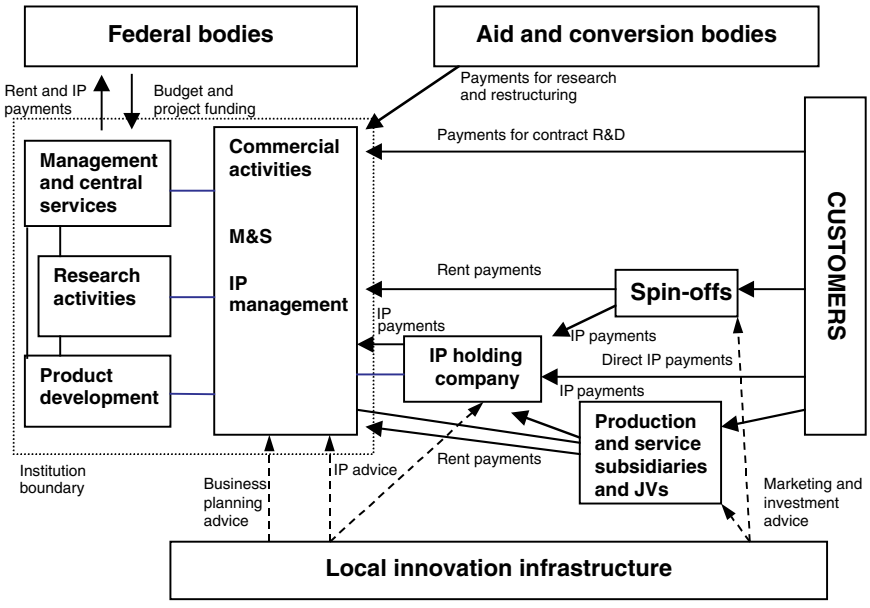

FIGURE 2 Schematic view of a model commercial structure for an R&D institution.

venture (JV), or by spinning off a separate company together with staff. The choice of which route depends on the desire to maintain the links and the commercial benefits of each option. Where production is involved, it is important not to be too ambitious if there is little experience in the institute and it is better to make a joint venture with an organization with the right track record. Sales or licensing of the technology is often not the route that gives the highest return, but it can have the lowest risk. Table 1 outlines the various options.

In the project, production joint ventures were chosen as the correct route. In the other cases the technology was exploited in subsidiaries or separate spin-off companies. In no case was a decision made to exploit via licensing or sale of the technology, although one of the institutions had used that as the main route to market in the past. In two cases in the project, R&D institutions decided to set up formal legal partnerships with other institutions and private companies. In each case there was a different reason. In one case it was protection against competition and price erosion. Three institutes decided to create a national center to promote the market (which was underdeveloped), share resources, skills, and facilities, and hopefully pull in other players to strengthen the position in Russia for export markets. In the other case the partnership pulled together a lead institute with a major university to ensure that students gained actual experience and were properly trained in a new area. Private business also took part and gained resources from the institute and the university, who in return gained extra funding. Part of this partnership was the formation of a national training center in the subject.

TABLE 1 Options for Exploiting Intellectual Property

Option	Indication
Exploitation within institute, but consider separate sales company	Use of facilities that rely on continuing federal support
Subsidiary	When business is linked to main activities and new staff must be recruited
Separate company with service and/or equity link	When a nonstate company is needed for investment or financial management purposes
Joint venture	When a partner is needed for production or distribution
Sale of technology to an unconnected company	When there is no desire to be involved in production or sales
Spin-off with no connection	Small-sized business where the returns are not worth the costs involved in making charges

OTHER FACTORS

There are two other issues that are important in controlling the potential for development—the legal and tax environment and issues relating to the location.

Unfortunately the legal and tax environment is not very clear. Several of the main laws relating to science cities and R&D are in conflict. Regulations on taxation on R&D institutions and the transfer of payments for rent and services tend to discourage commercial activities apart from contract research. Also, export duties on certain goods and government constraints on strategic materials and equipment are disincentives. All these areas need attention, and where there is a priority for the development of a nuclear city, specific incentives need to be put in place. A special area is the legislation on intellectual property ownership. The legacy from the time of the Soviet Union is a set of laws that worked well then but are no longer consistent on the conflicting rights of the author, the originating institute, and the funding body. Preferably the originating body needs to be given clarity and the option to make a clear legal contract with the authors and the funding body on how they will benefit, if at all. The validity of Russian patents overseas is very tenuous, and in some countries, proving first discovery is difficult and, in some cases, unfair towards countries like Russia. The cost of worldwide patenting is usually prohibitive and a burden on institutions. A fund to help in this area would be one solution.

Finally, there is the question of the city environment. In some cities like Obninsk and Troitsk, the large R&D centers are closed, but the cities themselves are open. Businesses outside the fences of these nuclear centers can be easily accessed. In closed nuclear cities, the lack of easy access is a problem that needs to have a solution if commerce is to flourish. Unless new technology businesses are linked into the wider business sphere, business will not grow and particularly foreign investment will not be gained. The solution is an administrative one and will involve a separation of the military and civil activities and the creation of a business park separate from the main city.

There is also the question of coherence and branding. In cities of the Tacis project, some degree of coherence is starting to drive the development of business. In Koltsovo there is a clear cluster developing in the area of pharmaceuticals, biotechnology, food products, and cosmetics that is driven by the skills of the staff and former staff of Vector. Vector is now a brand that has some degree of recognition.

Similarly in Obninsk, the original nuclear focus of the town has widened, and the various R&D institutions are driving a four-pointed set of commercial activities of radiation science, environmental problems, process industries, and energy. These are not so coherent as in Koltsovo but are

sufficiently so to allow benefits to be obtained. The Institute for Physics and Power Engineering (IPPE) is developing the FEI brand, and Obninsk needs to continue to encourage more coherency rather than less (see Figure 3). So far Reutov has concentrated on diversification rather than focus, but the areas of environmental products and information technology offer the basis for some future coherency with the original aerospace work.

CONCLUSIONS

- Research and production organizations need to change their culture and internally reorganize to prepare for more effective commercial activity.
- The federally funded research base needs to be preserved as a source of technology for business development—in the absence of a university-based R&D activity.
- Research and production organizations need to be flexible and imaginative in the types of commercial activities they develop.
- The town should look for some coherency of business to stimulate cooperation between organizations and attract industry.
- The establishment of a city brand should be considered based on the common science and technology activities.
- Innovation activities should also be part of an overall plan supported by an efficient infrastructure.

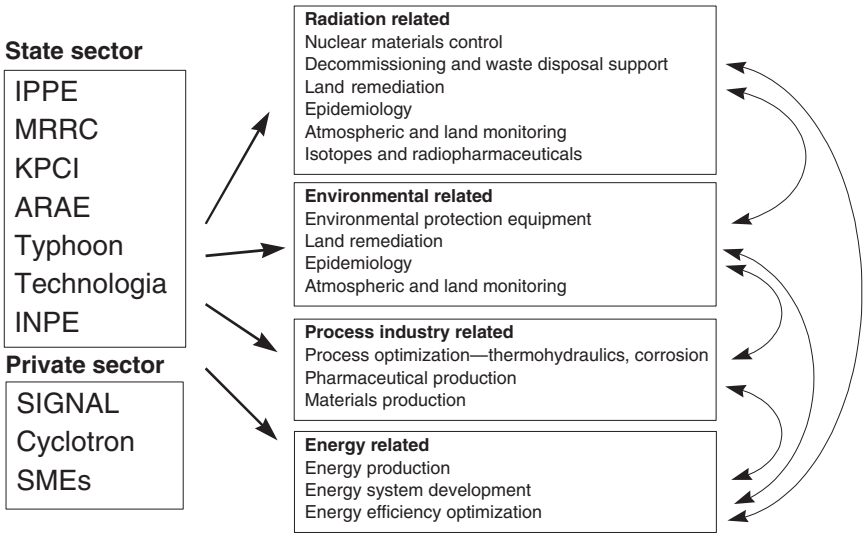

FIGURE 3 Coherency of business in Obninsk driven by the subject areas of R&D institutions.

• Intellectual property ownership needs to be clarified and simplified to the benefit of the originating institutions.

PROJECT PUBLICATION

Innovative Development of Territories in Russia and the European Union: Experience, Problems, and Outlook (in Russian)

Vol. 1 The Science and Technology Potential of Russia and its Application.
Vol. 2 The Practice of Economic Development of Territories: Experience in the European Union and Russia.
Vol. 3 Commercial Development of Russian R&D Organizations.
Vol. 4 Regions of High Concentration of Scientific and Technological Potential in Countries of the European Union.
Vol. 5 Science Cities of Russia: From Methodology to Practice.
Vol. 6 Problems and Future Development of Russian Territories with High Concentrations of Scientific and Technological Potential.
Vol. 7 Science, Innovation, and Business: Anglo-Russian Glossary.
Moscow 2001, Pub. ScanRus.
Dual language HTML version of Vol. 3 available in CD-ROM form from *juan.matthews@pera.com.*

Russian and American Business Practices and Laws: Advice to Businesses in Russian Nuclear Cities

Blaine A. Gibson
Siberia-Pacific Company

I have enjoyed visiting all of you from the administration, scientific community, and your state and private businesses, and want to share with you some of my observations.

STARTING A BUSINESS

When you are starting a business, you need to have a clear definition of whether you are a private company, a state company, or a scientific research institute. Major problems and confusion arise when you start acting as more than one of these.

If you are trying to make money, you need to have a business plan that clearly defines

- mission of the business
- ownership structure
- management
- marketing and sales strategy
- operations
- financial projections, including revenues, expenses, profit, and taxes

I have observed a lack of clarity over ownership and management structure and will address those in particular. In your nuclear cities, there are many private companies that are spin-offs or that cooperate with a state company or scientific research institute. Let us discuss this especially relevant example first. The company needs to define its relationship

with the state company or research institute in a written agreement—a contract. This agreement must answer the following questions:

- Are you separate entities and merely renting space? This is the relationship we saw when we visited RSTR Technologia. It has a clearly defined rental contract, with separate private and state companies, which is ideal for mutual interest and very professional.
- Are you partners? Does the research institute own a share of the private company? If so, are you sharing expenses and profits? The agreement must clearly define how.
- Define the duties of the private company and research institute or state company. Who is providing equipment, labor, technology, and capital?
- Try to avoid too many partners. It is often best to be small and simple. We saw an excellent example in the firm Eridan-1.
- If using technology or selling technological products coming from a university or research institute, you need to have a licensure agreement. Resolve whether you pay a fee or share profits. A fee agreement is preferable because it is simpler and will result in fewer disputes.
- If sharing managers, you must define their roles and the time resources they will devote to each project. It is preferable to have separate management for the private company or research institute or center. Medbiopharm produces great technological products but needs to work on this question.
- If sharing labor between a private company and a research institute or center, you need to clarify the worktime devoted to each and where the salaries come from. You need to have separate budgets. In visiting Medbiopharm, I observed a need to address this question.

It is not sufficient to handle these questions informally, (e.g., by approximating that half the time workers and managers will work for the company and by agreeing we'll use the institute's technology, sell products, and then decide how we will divide the profits—later when we are profitable). This is a recipe for disaster, and the sad thing is that the more profitable you become, the more complications and disputes arise.

RELATIONSHIP WITH LOCAL GOVERNMENT

A company needs to define its relationship with the regional and city administrations. Preferably government regulates you and taxes you fairly, provides necessary licenses quickly, and lets you run your business. Is the regional administration a partner? Are regional administrators partners? Preferably not. Having government as a partner leads to complications and conflicts of interest. Governmental entities are almost never partners

in American businesses. However, I am aware that in Russia it is common. When it is necessary, it is best that the regional administration or administrator's share is limited to 10 or 15 percent, not a controlling interest.

SUMMARY

Businesses need to clarify the relationships discussed above for the following reasons:

- to achieve long term profitability. Following this advice will help maximize efficiency and minimize disputes. In a business the right hand needs to know what the left hand is doing.
- to comply with Russian laws covering articles of incorporation (*ustav*), shareholder agreement (*dogovor*), and licensure
- to obtain financing, from Russian banks, but especially from any private foreign investors, international organizations, foreign governments, or financial institutions

Yesterday we heard a great deal of discussion among scientists and government bureaucrats about how government can help business. There are some things government can do, but they are limited to helping with technoparks and incubators. Meanwhile, businesses must grow up and stand alone. The main thing government can do is tax reasonably, regulate fairly, grant licenses and clear customs quickly, and leave you alone. Local administrations need to focus primarily on how they can help businesses in this second way.

Technoparks and incubators can be helpful, but businesses need to focus more on their own business plans, structure, development, and marketing. Businesses need to work with one another. Institutes and businesses wishing to develop markets for their technology should take Dr. Trivelpiece's repeated suggestions to contact and invite foreign companies. This should be done now, and there is no reason to wait or rely on government to begin these initiatives.

Support for Innovation Activities by the City Administration: Review of Innovative Firms in Zheleznogorsk

Pavel V. Yakushin
First Deputy Mayor of Zheleznogorsk

INTRODUCTION

I am glad to have the opportunity to participate in this international seminar. The issue of developing new science-intensive businesses and innovation projects is an urgent one these days, especially for closed cities such as ours. Like other closed cities of the Russian Ministry of Atomic Energy (Minatom), Zheleznogorsk has accumulated a great deal of scientific and technical potential backed up by a strong industrial base and enormous experience working in areas requiring highly specific knowledge and skills. Like most of the "science-intensive" cities of Russia, we have faced a serious problem: How can we use this potential effectively? How can we turn the innovative technologies we have developed into successful businesses and provide jobs for highly qualified personnel displaced from the nuclear weapons complex because of cuts in defense orders and the diversification of the defense enterprises around which our cities are based? I think this is a mutual problem, a mutual headache for us, the city authorities, and the management of these enterprises.

I would like to take this opportunity to express my sincere gratitude to the organizers and sponsors of this seminar, including the Russian Ministry of Atomic Energy, the U.S. National Research Council, and the Obninsk team. I hope that during our discussions and meetings at this seminar I will be able both to share my experience and to see different ways of solving the problems I have mentioned. I also think that our dialogue here will become the first step in our cooperation in the area of innovation development.

I would like to devote my report first to the efforts of the city administration aimed at developing science-intensive industries and the experience we have accumulated in this area. I will then discuss the activities of specific innovative enterprises, including their problems and difficulties, and sum up our experience resolving these problems.

BRIEF REVIEW OF THE SOCIOECONOMIC SITUATION OF THE CITY

I would like to start with a brief presentation on our city, its current socioeconomic situation, and the role of the defense enterprises around which the city was formed.

Like other similar cities, Zheleznogorsk was founded to fulfill important national objectives related to strengthening the defensive capacity of the country. In the late 1940s and early 1950s, the Soviet Union launched the so-called "nuclear project." An entire system of secret cities was created under the auspices of the USSR Ministry of Medium Machine-Building. They were united in a single research and production complex engaged in mining and processing fissionable materials and manufacturing equipment for the atomic energy industry and the military. Zheleznogorsk grew into a city from its origins as a workers' settlement created for the construction of a defense enterprise, Combine 815 (now called the Mining and Chemical Combine Federal State Unitary Enterprise).

Zheleznogorsk is located on the Yenisei River approximately 60 kilometers northeast of Krasnoyarsk. The following main enterprises are located in the city:

- the Mining and Chemical Combine (MCC), which is under the auspices of Minatom. Its core activities involve reactor production, spent fuel storage, mechanics, and environmental radiation monitoring.
- the Research and Production Association of Applied Mechanics (NPO PM) of the Russian Aerospace Agency. Its core activities include the design, production, and control of satellites for communications and navigation; the design and production of antenna systems; mechanics; and instrument making.
- two construction companies, Sibkhimstroi and Atomstroi. Their core activities involve construction and installation work for industrial and civil sites, including MCC facilities.
- the Chemical Plant, a subsidiary of the State Enterprise Krasnoyarsk Machine-Building Plant. Its activities involve finishing work on jet engines and technologies for reprocessing jet engine fuel.
- the Sibalko distillery

It should be noted that even today, these city-forming enterprises continue to play a defining role in the socioeconomic life of the city. Following are several pieces of evidence in this regard.

The current population of the city is 103,000, with 52 percent of the working residents being employed by the main enterprises as of the first half of 2001. By the way, the number of people employed by the city-forming enterprises has decreased from 30,000 in 1992 to 20,000 in 2000.

During first six months of 2001, the volume of goods and services produced by the main enterprises comprised 80 percent of total output volume in the city. The greatest share comes from MCC and NPO PM, as shown in Table 1. This ratio has been maintained over the past several years, though it should be mentioned that NPO PM's share has increased slightly.

It is interesting that the picture for tax proceeds is somewhat different. During the past six months, about 52 percent of all tax revenues received by all levels of government came from the city-forming enterprises, as shown in Figure 1. The main taxpayers are still MCC and NPO PM, but Sibalko is beginning to play a significant role in providing tax income for government budgets.

Thus, it is becoming clear that economic and social stability and the further development of the city are directly connected with the situation at the city-forming enterprises.

I would like to note that the city has created all prerequisites for the development of innovative businesses. The city's enterprises have accumulated great scientific and technical potential due to their highly qualified personnel and well-organized production base. In addition to their core activities, the enterprises have conducted scientific research in related and completely new areas. Fundamentally new technologies and products have been developed, with some of them having no analogues in Russia or abroad.

TABLE 1 Output Volume by Main Zheleznogorsk Enterprises

Enterprise	Percentage of Total Output Volume for City
MCC	25
NPO PM	26
Sibkhimstroi	9
Atomstroi	10
Chemical Plant	4
Sibalko	6
Other enterprises	19

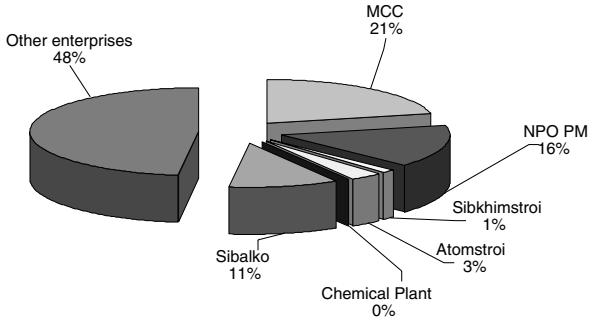

FIGURE 1 Breakdown of tax revenues for the first half of 2001.

Besides its scientific potential, the city also has other necessary conditions for the development of innovative businesses, including the following:

- a well-developed system of human resource training. There are four branch campuses of Krasnoyarsk state higher educational institutions: the Krasnoyarsk Technical University, the Siberian Aerospace Academy, the Krasnoyarsk Pedagogical University, and the Krasnoyarsk Academy of Nonferrous Metals and Gold. About 1,310 students are currently enrolled at these institutions, 835 of whom attend regular daytime classes. Specialized secondary educational institutions (trade schools and an industrial college, with a total of 2,180 students enrolled) prepare specialists for work in the city-forming enterprises.
- a well-developed financial infrastructure. There are six lending institutions in the city, which have a great deal of experience in interacting with the city-forming enterprises. They provide credit for the ongoing activities of the enterprises and are implementing programs to provide credit to their employees.
- a good social support structure for citizens. The amount of public funds spent per citizen is several times higher here than in neighboring regions. The social support system is functioning.
- acceptable living conditions. The city economy is maintained at a good level. Work is constantly under way to repair and upgrade public utilities, beautify the city, and maintain green spaces. There is a good system for intra- and intercity freight transport and a well-developed telephone system. Residents of the city have never encountered problems with shutdowns of the local water and power supply systems.

Thus, to my mind, the task of the city administration and the enterprises is to use this potential and create successful businesses on the basis of innovative technologies and products.

I would like to say that we have devoted no small amount of effort to conversion projects. Quite a lot of experience has been amassed, and I would like to share some highlights with you now.

I would like to start with the experience of two city-forming enterprises, MCC and NPO PM, since they are the main sources of innovation ideas and projects.

MCC: EXPERIENCE IN DEVELOPING INNOVATION PROJECTS

As you know, MCC is the main city-forming enterprise of federal significance located in the closed city of Zheleznogorsk. Key radiochemical production facilities are situated deep in the Siberian rock and are without analogue in the world.

For many decades, MCC produced weapons plutonium from natural uranium. Plutonium was supplied to other enterprises, where it was used to manufacture nuclear warheads. At the same time, the rest of the uranium was recovered to be reused in reactors.

This objective was pursued through the operation of two graphite-moderated, light-water-cooled reactors, which were shut down one by one in 1992 because of changes in the world situation. A third reactor with a closed-loop cooling system continues to live and "breathe" at present. An underground nuclear heat and power plant has been built around this reactor, and it now provides heat to practically all parts of the city. According to a U.S.-Russian intergovernmental agreement signed in March 1992, Russia was to have shut down all reactors of this type by 2000. This deadline was later extended to 2006.

MCC currently employs about 9,300 people, almost half of them being specialists with university or vocational school degrees.

The present core activities of the enterprise are as follows:

- MCC carries out radiochemical reprocessing of irradiated fuel from the ADE–2 reactor. The extracted plutonium is stored at the enterprise and, in accordance with the intergovernmental agreement, is not used for weapons production. Compliance on this point is monitored by American observers.
- The enterprise is also involved in the "wet" storage of irradiated nuclear fuel from VVER–1000 reactors (the capacity of the storage facility is about 6,000 metric tons). The facility is currently 35 percent full, and work is under way to expand capacity to 9,000 tons.
- Sites related to the production of weapons plutonium are being shut down in accordance with the Program for the Decommissioning of Defense Facilities and Eliminating the Consequences of Defense Activities at MCC.
- A plant is being built to produce silicon for the semiconductor industry. This major conversion project includes the creation of an indus-

trial complex for the production of silicon semiconductors, beginning with the raw material, trichlorosilane, and ending with silicon wafers.

Now that the military production activities of MCC have been reduced, the combine is developing other types of activities. Some of them are based on the enterprise's experience working with fissionable materials. These include unique technologies developed by combine specialists that can be characterized as innovations:

- a dry (air-cooled) storage facility for spent nuclear fuel with a capacity of 30 tons
- a demonstration center for the extraction of liquid radioactive wastes and the decommissioning of storage tanks for such wastes
- demonstration of a remote-controlled system for monitoring leaks of salt solutions from tanks of highly radioactive waste pulps
- a center for the chemical analysis and assessment of problems connected with various liquid wastes, including vitrification
- a demonstration center for decontamination and recycling of metals
- technically advanced facilities for the temporary storage of plutonium dioxide

All of these projects are undoubtedly interesting and promising. However, all of them are directly related to the former core activities of MCC and cannot be implemented as independent projects.

I would also like to discuss a number of projects aimed at creating and developing the production of nonmilitary items, projects that can provide new jobs for MCC specialists dismissed because of defense cutbacks. These projects are innovative to a greater or lesser extent; that is, MCC specialists developed them either directly or by improving on ideas borrowed from other sources.

Some of these projects have currently ceased operation, while others involve separate units and facilities within the combine itself. I will briefly discuss the essence and aims of these projects and attempt to summarize their experience and illustrate the basic difficulties and problems confronted by specialists. Finally, I would like to cite the results of an analysis of these problems and indicate possible ways of resolving them.

I shall begin with the projects that are either partially or completely inoperative at present:

Production of artificial crystals. At one time, MCC acquired and developed a technology for growing artificial emerald crystals and brushes. These materials are widely used in jewelry manufacturing and are in rather great demand because natural emeralds are very rare and expensive. The production of these materials was organized at a separate enterprise staffed by MCC specialists. Equipment was purchased, the technology was per-

fected, and several pilot batches were produced. The new enterprise established contacts with Russkie Samotsvety [Russian Jewels], a major St. Petersburg jewelry manufacturer, and sold the company several lots of emeralds.

Production of super pure materials (tellurium, gallium). The technology developed by MCC specialists made it possible to achieve an admixture content of 10^{-4} percent. Gallium is used in microelectronics, optoelectronics, and semiconductor equipment in preparing compounds for large and super-large integrated circuits, lasers, and photodetectors. Tellurium is used in electronics and semiconductor equipment for manufacturing highly efficient thermoelectric generators and refrigerators.

Production of thermoelectric modules and materials (TEMO). TEMO is a compact solid-state thermocompressor that circulates thermal energy during the transmission of direct current. A unique feature of this module is the simplicity with which it shifts back and forth from cooling to heating modes by changing current polarity. The difference in temperature between the hot and cold sides of TEMO is about 70 degrees C. These characteristics allow TEMO to be used in machines and equipment requiring cooling, heating, or maintenance of a stable temperature under widely varied operating conditions. Therefore, the uses for this device are practically limitless, covering a wide range of products:

- all types of refrigeration equipment—domestic and automotive systems, air conditioners
- space technologies, laboratory equipment, industrial equipment
- medical devices (thermocontainers and isolation chambers)
- electronic and computer systems (processor cooling systems), and so forth

A pilot site for TEMO production was created at MCC, with modules being assembled manually in small lots. A pilot consignment of modules was purchased by the Miass Machine-Building Factory. All documents required for product certification were prepared. Using funds from the federal targeted program for the development of the closed city of Zheleznogorsk, the city administration allocated about 6 million rubles in 2000 to create a manufacturing unit (automated assembly line) to produce thermoelectric modules.

However, despite the fact that the project was moving along rather well, MCC management decided to terminate the activity and dismiss the personnel involved.

And now I would like to briefly discuss MCC conversion projects that are still functioning.

Production of biologically active preparations, namely CO_2 extracts from Siberia's renewable plant resources. Currently MCC has a pilot unit for the production of plant extracts using liquid carbon dioxide. The extracts can be used in medicine, perfumes, cosmetics, and foods. Plans call for launching production of a new generation of plant growth stimulators, pesticides, and herbicides. In addition, the extracts are being constantly studied to find new properties for expanded applications. It should be noted that the project is supported by the Russian-American Nuclear Cities Initiative.

Recycling of mercury-containing lightbulbs. MCC has a pilot unit for recycling old luminescent bulbs and other mercury-containing articles. This helps to resolve certain environmental problems in the city and the region.

Development of a machine-building complex for producing equipment and spare parts for the aluminum industry. This project is being implemented by the Mechanical Repair Plant (MRP), a structural subunit of MCC. MRP ensures the safe operation of the main technological equipment involved in nuclear power production at MCC. With the cutbacks in core activities at MCC, a decision was made to start producing aluminum electrodes for the aluminum plants of the Krasnoyarsk region. A unique technology developed by the Krasnoyarsk Scientific-Research Institute of Physical Engineering is being used, namely alloying heterogeneous metals by means of explosion. A special chamber in which dozens of articles can be alloyed at once was built especially for this purpose in the underground facilities of MCC.

This project can today be called one of the most successful conversion projects implemented by MCC. MRP is continually expanding the range of its products and markets. In 2000 the sales volume for this product line was about 30 million rubles (almost 15 percent of the entire sales volume for MRP on the whole).

The project has also received financial support from the Program for the Development of the Closed City of Zheleznogorsk in the amount of 30 million rubles.

MCC Radiation Technology Center (RTC). Like MRP, RTC is a subunit of MCC, but its activities are not related to the operations of the combine itself. RTC facilitates the development of the production complex by manufacturing medical products. Solid concentrated radon, radon generators, and the nonwoven bandage material Algipor are currently being produced successfully. I will discuss this enterprise in greater detail in the second part of my report, which covers the innovation activities of certain enterprises.

I would now like to summarize the experience accumulated by specialists during the implementation of various projects and try to categorize the general problems they faced. I would like to subdivide these problems into two groups.

The first category includes reasons of a macroeconomic nature:

The unstable economic and political situation in Russia and the Russian economic crisis. Most of the projects I have mentioned began in the early or mid-1990s. At that time, established relationships between producers and consumers were destroyed, and some enterprises went bankrupt. It might be said that there was no domestic market as such for some of MCC's products. For example, this seriously impacted the production of super pure materials and plant extracts. Nevertheless, specialists at the enterprise who were interested in implementation of projects and creation of successful businesses tried to establish contacts with potential exporters of products. However, existing export restrictions (including those related to the core activities of MCC) made it impossible to forge long-term relationships with potential consumers.

On the other hand, the Russian economic crisis limited opportunities for MCC to develop its various conversion projects because of a lack of funding and the primary need to maintain its core activities.

Lack of stable targeted sources of funding for innovation projects and conversion activities. This problem is directly concerned with the spinning off of innovative technologies into separate businesses. Today these projects are funded individually, basically from targeted Minatom funding sources, and this funding is of a one-time, unsystematic character. That is why most MCC projects stall at the R&D or product sample stage. I would say that because of the lack of an investment market, we lack the mechanism for commercializing projects and subsequently creating effectively functioning enterprises.

Undeveloped market infrastructure; lack of constant sources of marketing information. While implementing almost every project, MCC specialists have faced the serious problem of finding information on market conditions regarding both the raw materials needed for production and the finished products to be manufactured. In some cases they literally had to piece together nuggets of information by themselves.

Unstable laws and regulations; bureaucratization of the economy, duplication of authorities of governmental and regulatory agencies. For example, RTC faced the problem of renewing their license for the production of concentrated radon. Besides the fact that the licensing procedure

includes many stages, the rules for obtaining licenses change constantly. This requires additional studies of a product that already has a license, which in turn substantially impacts the financial status of the project. Furthermore, the procedure is complicated by the excessive bureaucratization of state agencies responsible for issuing various permits. As a result, the license renewal process for the radon dragged on for a year and a half.

Low level of the technologies used; equipment used in industries nationwide is worn out and obsolete. To initiate even pilot production units, many of the above-mentioned projects required unique, highly reliable, and highly efficient industrial and laboratory equipment. In the majority of cases the enterprises had to produce such equipment themselves or purchase it abroad, which substantially affected project costs and, consequently, project effectiveness on the whole.

The second group of problems includes those connected with MCC activities and the relations of the combine with Minatom.

Lack of specialists meeting the requirements of the modern market economy. The essence of this problem is as follows: Although MCC has highly qualified technical specialists, in view of the specific nature of its activities, the combine does not have specialists in such areas as marketing (market research and analysis, development of marketing strategies for various types of business activity), sales, or middle management.

Economic dependence of innovation activities. As you have probably already noticed, almost all MCC innovation projects were implemented and developed not as independent entities, but as MCC divisions. At best, they were set off in separate structural subunits of the combine. On the one hand, this is quite understandable and justified, especially in the initial stage of project development, namely the stage of R&D and experimental sample creation. However, at later stages, when these units had begun to operate and produce products, problems appeared. These problems were connected with the units' lack of economic independence and their inability to influence policies regarding the distribution and reinvestment of income earned through their activities. This hindered further development of these business activities.

It should be noted that the organizational structure of the enterprise itself did not contribute to successful development of these projects within MCC. For example, both procurement of raw materials needed for production and sales of goods produced are centralized. In a number of cases, this situation has led to losses of strategically important partners and decreases in sales volumes. Partly for this reason, many innovation

projects have stalled at the pilot production stage (as happened with TEMO production, for example), and some of them have shut down completely.

As another reason for MCC's unwillingness to rid itself of unnecessary types of activities, I would cite the complicated procedures for transferring (leasing, selling) state property.

Minatom's policy on MCC conversion projects. This problem is directly concerned with Minatom's policy on the development of MCC conversion projects. It is aimed at supporting further conversion and restructuring of the enterprise and reducing and subsequently terminating the defense-related activities of MCC. However, Minatom and MCC itself have focused their efforts on major projects and areas, such as the construction of the silicon plant and the spent nuclear fuel storage facilities.

I think that, on the one hand, this policy is justified. To achieve results in a short period of time, the combine, in cooperation with Minatom, should focus on implementing such large projects, including those that are purely conversion-oriented and those that are somehow related to the core activities of MCC. However, I also think that insufficient attention is being paid to conversion projects that are not on the scale of the silicon plant but could still become very successful businesses based on cutting-edge technologies developed at MCC.

Thus, in conclusion, I would suggest that Minatom and MCC join forces to achieve the following goals:

- A well-considered program must be developed to support and fund "small" conversion projects. For this purpose, MCC management should be given incentives to spin off these projects as separate entities, perhaps as subsidiaries at the initial stage.
- A program should be created to restructure the enterprise by detaching some of its business units as separate self-sustained entities.
- Using funds from the federal (Minatom) budget, targeted investment funds should be created to develop small conversion and innovation projects. Procedures for obtaining money from these funds should be considerably simplified. Funds should be strictly targeted in order to preclude opportunities for the combine itself to use them for other purposes. The results of investments should be strictly monitored. The making of decisions on the allocation of funds should be based not only on the timeliness and prospects of the project but also on the organizational structure proposed for implementation of the project as an independent entity.
- Procedures for the transfer of state property must be simplified to provide an opportunity for reducing the price of the property when it is sold or leased when the project is concerned with MCC innovation activi-

ties. A mechanism should be developed for transferring equipment and production facilities on preferential terms if they are to be used for implementation of promising conversion projects.

ACADEMICIAN M.F. RESHETNYOV RESEARCH AND PRODUCTION ASSOCIATION OF APPLIED MECHANICS (NPO PM)

There is another unique enterprise in the city that also has vast innovation potential and practically no analogues in Russia. This is Russia's leading enterprise in the design and manufacture of satellites for communications, television broadcasting, retransmission, navigation, and geodesy. It was founded in 1959 as a branch of S.P. Korolyov's Design Bureau No. 1. The enterprise initially designed rockets and satellites. Since it became an independent entity, it has produced only satellites. To date, all functioning Russian communications satellites have been produced by NPO PM.

In 40 years of rocket and space activities, more than a thousand NPO PM space devices were launched, and more than 30 space communications, retransmission, navigational, and geodesic systems were designed, along with a universal light-class carrier rocket. Currently about 80 NPO PM satellites are in operation.

On April 18, 2000, the new Siberian-European satellite (SESAT) was successfully placed in orbit. Produced for the first time in Russia on an order from Eutelsat in cooperation with the Alcatel Company (France), it relays television broadcasts for Western Europe.

The enterprise employs about 6,000 people. NPO PM is currently experiencing difficult times, primarily because of the insolvency of its customers.

It should be noted that NPO PM encountered serious problems during the economic crisis, which affected the financial status of the enterprise. Volumes of state orders and funding for space-based communications, telecasting, and geodesic systems were substantially reduced. The enterprise has begun independently seeking customers and partners. NPO PM management has taken some rather drastic measures to keep the enterprise afloat, including reducing the number of employees by half (see Figure 2).

The enterprise has begun ridding itself of unnecessary assets (mostly of a social nature) by having them reclassified as municipal property. Furthermore, some projects have been spun off as independent (subsidiary) enterprises, and NPO PM has focused its efforts on its core activity, the production of satellite systems.

I would now like to discuss the activities of one of several NPO PM subsidiaries, which is currently continuing its successful efforts to develop the "mother" enterprise that gave it life.

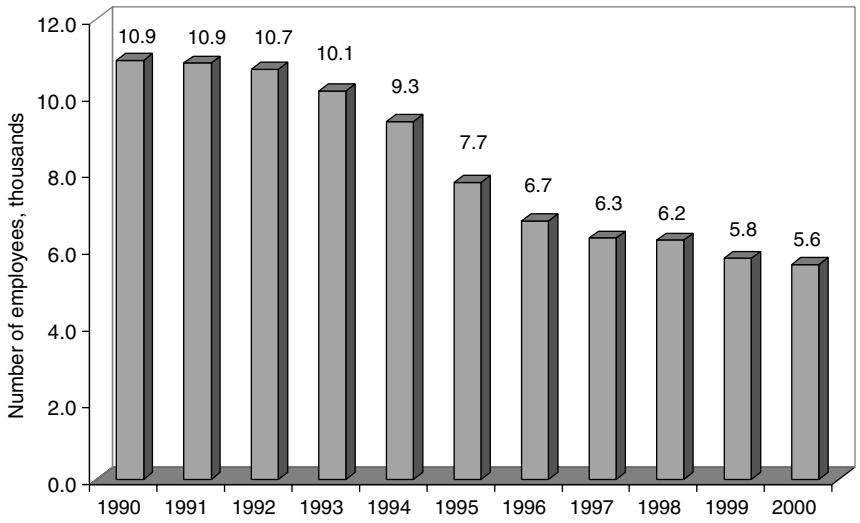

FIGURE 2 Employment trends at NPO PM.

NPO PM–Development

The State Unitary Enterprise NPO PM–Development was founded in 1997 as a subsidiary entity. It was established by NPO PM for the purpose of spinning off an entire business unit involving the land-based elements of data reception and transmission, from system design to the completion of working systems for clients on a turnkey basis, along with subsequent technical service as required.

The core activities of the enterprise are as follows:

- production of large-diameter antennas for broadcasting and satellite use, as well as other equipment for satellite stations
- production of transceiving centers and systems for multiple television signal reception
- production of cable television systems

Over the past 18 months, television systems produced by the enterprise have been installed in Zheleznogorsk, Achinsk, Nazarovo, and Minusinsk in Krasnoyarsk Territory and the city of Chernogorsk in the Republic of Khakassia.

NPO PM–Development employs 450 people, with 50 of them being full-time permanent employees and the rest being engaged as specialists

for short-term projects on a contractual basis. Most of them are employees of NPO PM.

Following are the main reasons for the success of this enterprise:

- organizational structure. By being a branch enterprise of NPO PM, NPO PM–Development gains the legal right to use the know-how and technologies being used by its founder to create highly complex and very reliable space systems.
- cooperation with NPO PM in preparing engineering and technical documentation and manufacturing some components for ground-based antenna systems. Furthermore, the founding company is ISO-9000 certified (meaning that it ensures the high quality of its products through various control methods and measures).
- cooperation with NPO PM by engaging its specialists and using its production equipment. This makes it possible for NPO PM–Development to save on production costs.

I would like to note that the city administration has supported the efforts of NPO PM–Development. In 1999–2000 the enterprise received two loans on preferential terms from the nonbudget City Fund to install cable television networks in cities of nearby regions. Both loans have now been repaid by the enterprise.

As another example of their work, at the request of the Krasnoyarsk Administration, the enterprise has been working on making a chiming clock. This clock will consist of four clock complexes, each weighting about 1.5 tons. The face of the clock will be 6.5 meters in diameter and its hands will be 4 meters long. The clock will have a high-accuracy mechanism with a special driving gear, sensors, and a computer-linked electronic control unit.

The operating structure of the enterprise has proven to be successful, as it made it possible to create a self-sustained entity at low cost and without attracting extra funds. But the plans of NPO PM–Development do not stop here—the enterprise now intends to create a completely independent enterprise with its own production facilities. This will allow it to expand its activities and develop independently of the position and strategies of NPO PM.

ROLE OF THE CITY ADMINISTRATION IN SUPPORTING INNOVATIONS

I would like to discuss the way in which the city authorities have facilitated the development of innovation projects in the city. I would like to share the experience we have gained in this area and present my ideas on changes that should be made in this regard.

Activities Involving the Investment Zone

To begin with, I must acknowledge the fact that the city authorities had no purposeful policy for developing innovation projects. Several years ago, as a result of the deterioration of the socioeconomic situation in the city, the weak business environment existing at that time, and the underdeveloped market infrastructure, the more or less successful businesses "migrated" to the territorial capital, Krasnoyarsk. At that time, the city administration launched a program aimed at supporting the development of new investment projects and the reorganization and financial revival of existing production enterprises.

The objective of this program was to increase our budgetary (tax) incomes, curtail the need for subsidies from the federal budget, and thus make our budget self-sufficient. And we managed to achieve rather good results. Figure 3 illustrates the structure of our budget in the past few years.

As the figure shows, our incomes increased substantially, peaking in 1999. This occurred thanks to the increase in tax revenues owing to activities in the investment zone. The investment zone provides for a special

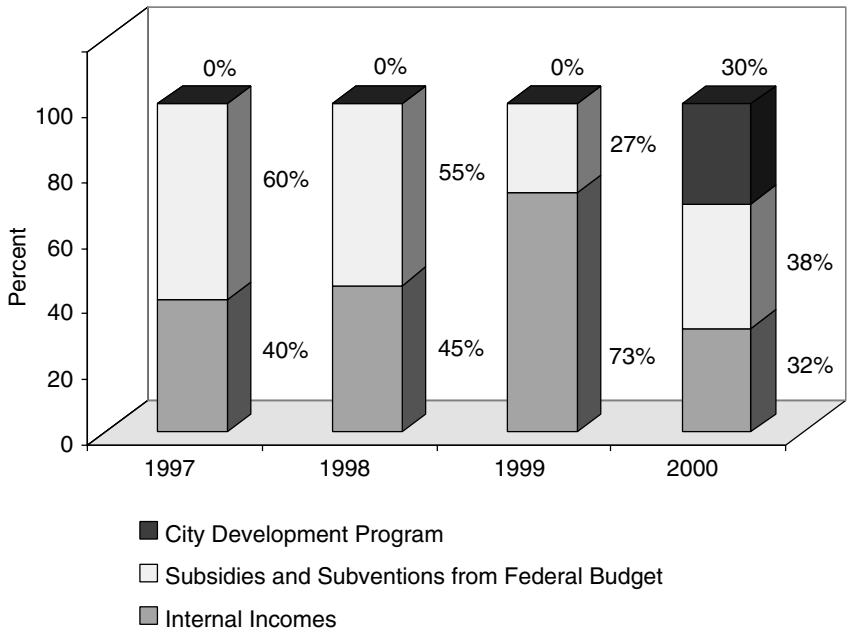

FIGURE 3 Structure of budget revenues for the closed city of Zheleznogorsk.

economic status stipulating the participation of enterprises in the socio-economic development of the city. This special status program was established to attract additional investments to develop for the city's economy, promote conversion projects, create new jobs, and aid in the implementation of social programs.

For the purpose of supporting the city-forming enterprises and saving jobs, in 1998–1999 the city governing bodies and enterprises entered into taxation agreements according to which the enterprises were to be granted tax privileges if they preserved jobs and paid their current taxes. This became possible, as you know, thanks to Article 5 of the Russian Federation Law on Closed Administrative-Territorial Zones, according to which all taxes and other revenues within these zones go directly into local government budgets.

Moreover, the establishment of the investment zone has energized the business environment in the city and attracted new enterprises and plants. Revenues from investment zone participants made it possible to establish an internal source of support for investment projects, the nonbudgetary City Fund, which provides funds on preferential terms to top-priority investment projects. These have included no small number of innovation projects carried out by the city-forming enterprises. For example, during its existence the fund has supported the following activities:

- development of production of bandaging materials (MCC)
- creation of a pilot facility for producing biologically pure substances (MCC)
- creation of a unit for producing the SILK plant growth stimulator (MCC)
- construction of a rare-earth metals plant (MCC)
- production of new construction materials (vermiculite, peat blocks) and improvement of construction technologies (Sibkhimstroi)
- production of Versa Module Europa (VME)–standard modules (NPO PM)
- production of power-saving equipment (heat exchangers) (NPO PM–EnergyDevice)
- creation of cable television and radio broadcasting networks (NPO PM–Development)

The total amount of financing is about 106.2 million rubles, while the amount of funds allocated for the support of innovation projects totaled only 8.3 million rubles (or 7.9 percent). Of the remaining funds, 84.7 percent were allocated to investment projects and 7.4 percent were used as floating assets.

Program for the Development of the Closed Administrative-Territorial Zone of Zheleznogorsk: Support for Conversion and Other Major City Projects

In 2000 the government of the Russian Federation decided to allocate 475 million rubles in targeted funds to the city budget to support the Program for the Development of the Closed Administrative-Territorial Zone of Zheleznogorsk. This was done as compensation for federal taxes normally paid to the federal treasury. During debate over this program in Minatom, it was noted that the Zheleznogorsk program was characterized by its orientation toward the development of new industries that would ultimately bring in additional tax revenues.

The funds destined to support the closed city development program for the year 2000 were allocated according to the following priorities:

- reconstruction of heating supply systems (MCC boilers): 112 million rubles
- MCC conversion projects: 70.7 million rubles
- city projects aimed at developing and creating new manufacturing facilities and repairing and reconstructing the heating and water supply systems: 284.7 million rubles

Among the conversion projects carried out by MCC, I have already mentioned the following innovation-oriented activities:

- creation of a complex of facilities for manufacturing medical supplies, gel-based bandages and dressings, and isotopic materials and providing radiation-based materials processing services
- development of a machine-building complex to produce equipment and spare parts for the aluminum industry
- creation of a facility that manufactures automated security and fire alarm systems and development of technologies for producing new fire protection equipment
- creation of a plant for manufacturing thermoelectric materials and modules, developing and improving TEMO automated assembly technologies, and manufacturing a wide variety of TEMO-based refrigeration and heating units

One city project that merits special mention is entitled Creation and Development of a Request-Response Data Transmission System for the Needs of Airlines. The project is of national significance and is intended to integrate Russia into the global Aircraft Communications and Reporting System (ACARS), which transmits data on the in-flight status of aircraft. The project is described later in this paper.

The Role of International Programs in Supporting Innovation Activities

The main objective of the city's policy is to provide favorable conditions for business development and to facilitate the creation of new enterprises and the expansion of existing ones. It should be noted that international programs play a substantial role in this regard.

One such international program is the Nuclear Cities Initiative (NCI). In September 1998 the Russian Federation and the United States entered into an intergovernmental agreement on the implementation of NCI, with the activities carried out under the program being financed by the American side. The primary goal of cooperation between Minatom and the U.S. Department of Energy under the NCI program is to create new jobs in the civilian manufacturing and services spheres, as well as to develop the necessary infrastructure and create a climate favorable for business growth in the closed nuclear cities.

To carry out these tasks, the International Development Center–Zheleznogorsk (IDC) Fund was established in November 1999. Its primary tasks are as follows:

- render services for conversion-oriented enterprises, entrepreneurs, and municipal projects
- promote the development of the city by assisting in the preparation of business plans for local enterprises; provide expert review and analysis of business plans that will serve as a basis for elaboration of city development programs. IDC specialists have reviewed all investment projects included in the city development program.
- provide information and technical support for various projects and programs (Internet)
- arrange educational activities. In 2000–2001, IDC trained 38 students under the Presidential Program for the Training of Management Specialists. Those activities are of great importance, as the city is encountering a shortage of management specialists.
- arrange activities in the area of social programs
- coordinate activities within the framework of the Technopark project

The city administration and the Mining and Chemical Combine have recently developed a project to create a technological incubator (the Technopark project) within the framework of the NCI program, which will make it possible to provide office and industrial space for MCC innovation projects. The project will facilitate efforts on a number of important city objectives, including the following:

- creation of additional jobs for highly qualified MCC specialists

- development and improvement of new technologies developed under MCC's conversion programs
- creation of new production enterprises using innovative technologies to provide innovative products or services or to commercialize innovative projects
- attraction of investments for the establishment of production facilities
- promotion of innovative technologies and products on the market

The first stage of the Technopark project has already been completed, including preparation of a package of documents outlining the strategy and nature of proposed technopark activities, procedures for the selection of innovative projects to be based on the site, and technical and economic background information on the feasibility of the project's operations. The site for the technopark has been selected, and several MCC pilot innovation projects have been chosen for initial placement at the site. The next stage will involve the actual "transplantation" of those projects from MCC along with the necessary personnel and equipment.

To sum up activities conducted by the city administration in support of innovation and investment work, I would like to focus your attention on two important points.

1. Direct financial support from internal and external city resources. As you have probably noticed, the majority of investment projects supported by the administration cannot be considered as innovative. The initial policy of the administration was aimed at supporting the undertakings that could provide the quickest returns to the budget in the form of increased tax revenues (as with the distillery) or that were of great social importance for the city (for instance, construction of the Red October candy plant, which provided jobs for about 500 people, mostly women). We should mention that this policy proved to be correct. The distillery is now considered one of the main enterprises in the city, as the volume of tax revenues it produces is comparable with the volume of revenues derived from the city's traditional main entities, MCC and NPO PM. I would like to note that the financing of innovation projects entails a high risk for whether the investments will be recouped or whether the project itself will ever be carried out, because such projects, as a rule, involve lengthy payback terms and great difficulties in market demand evaluation. Therefore, I believe that at a time when free financial resources are in short supply, the local authorities must focus mainly on creating a favorable environment for innovation projects.

2. Creation of a comfortable infrastructure for business development. I think that this activity is no less important than direct financial

support. Experience gained over the course of many projects shows that without the necessary infrastructure—qualified managers, information technology, business support systems—many projects that had seemed promising will not meet expectations. This is particularly true with regard to innovation projects. After all, their founders are frequently scientists and highly qualified engineers without the skills needed to work in rapidly changing market conditions and create and organize effectively operating businesses. Hence, the Techopark project has been developed to bring scientists and qualified managers together.

Concluding the issue of support for innovation activities by the local authorities, I would like to note that, in my opinion, support for such projects should be based on well-considered policies of the federal government. This means not only financing, but also the creation of favorable conditions for project implementation.

EXPERIENCE OF SMALL INNOVATIVE ENTERPRISES

I would now like to discuss the experience of small innovative firms in the city.

Applied Mechanics Telecom Open Joint-Stock Company: The Successful Spin-off of a Project from a City-forming Enterprise

In June 1998 Applied Mechanics Telecom (Prima Telecom) was established as an affiliate of NPO PM, which was established in September 1992. The founders of the closed joint-stock company NPO PM are approximately 10,000 employees of the Academician M.F. Reshetnyov Federal State-owned Unitary Enterprise NPO PM.

From its founding, Prima Telecom has pursued two main areas of activity: finance and investments and manufacturing. As a production entity, Prima Telecom specializes in providing equipment for professional satellite television reception, manufacturing and supplying antennas, feeder devices, and equipment for television and radio broadcasting and communications, and creating and operating cable television networks that meet all modern requirements.

Since 1994, in order to outfit satellite television reception stations with state-of-the-art electronic equipment, Prima Telecom has maintained direct contacts with leading foreign equipment manufacturers and major domestic suppliers (Universal Communications Corporation of Moscow, General Satellite Corporation of St. Petersburg, etc.). This has made it possible not only to reduce the cost of the equipment but also to provide high-quality performance, which was confirmed in certification testing in 1996.

With the growing demand in the regions for capabilities of broadcasting their own programs to a wider audience, Prima Telecom used its

experience to begin designing and creating regional satellite TV systems. Major deliveries of satellite TV equipment have been made to Yakutia and Buryatia and to TV centers in Primorye and Khabarovsk territories. Also, large-diameter TV receiving-transmitting stations have been installed in the cities of Chita and Khabarovsk. Prima Telecom has been actively involved in upgrading the Yenisei satellite TV receiving system in Krasnoyarsk by providing automated satellite tracking capabilities. The company has also upgraded receiving stations of the Moscow and Ekran systems for the All-Russia State Television and Radio Company.

In 1997 Prima Telecom successfully fulfilled a prestigious order for installing a satellite TV receiving system at the Sosna presidential residence in Udachny, Krasnoyarsk Territory. During the meeting of the Russian president with the Japanese prime minister, this system provided reception of 17 satellite channels as well as a pool feed to the head receiving station WISI (Germany) that was distributed to 100 subscriber stations in and around the residence.

In 1999 and 2000 the major central television companies began transmitting their programs via satellite in digital format. At the request of these companies, Prima Telecom measured the digit signal level and then, for the first time in the region, began supplying and servicing equipment for receiving programming in the MPEG-2 DVB-S digital standard.

The establishment of close contacts with the majority of regional television transmitting centers in Siberia, the Baikal area, and the Russian Far East, as well as practically all the newly established independent broadcasting companies, revealed several problems. The then-existing radio and television towers were overloaded; antennas were worn and technically obsolete. There was no possibility of installing antennas for transmitting new channels, and indeed there were no antennas available at an acceptable cost with characteristics that would satisfy the increased demands of customers.

In 1994 Prima Telecom established its own facility to manufacture tracking filters and transmission antennas for radio and television broadcasting. The use of tracking filters eliminates the need for installing costly additional feeders and antennas while broadcasting in one frequency band and even in adjacent bands, which substantially cuts the cost of modernizing and expanding broadcasting centers.

Prima Telecom entered the international market in 2000, when it supplied a $72,000 antenna-feeder complex to the Turkmenistan Radio and Television Production Association. A new contract for $80,000 has recently been signed, and there are good prospects for future cooperation.

To increase production output and cut production time, Prima Telecom acquired additional facilities in late 1999, which are now being renovated to provide space for a pilot plant.

In July 2001 Prima Telecom won an open competition to supply 16 million rubles worth of equipment to be used for projects under the regional targeted Program for Modernization and Development of Radio and Television Broadcasting in Krasnoyarsk Territory in 2001–2005.

Having begun creating its own cable television systems in various cities of Krasnoyarsk Territory in 1998, Prima Telecom is now one of the largest cable television operators in Siberia. As of August 1, 2001, Prima Telecom and its five affiliates had 29,924 cable subscribers.

Cross-polar Flight Development Project

The next enterprise I would like to cover is the Northern Air Bridge Management Company, an open joint-stock company. This enterprise has developed a federal-level project for creating a fundamentally new infrastructure for regular flights along cross-polar air routes from North America to South and Southeast Asia by way of the North Pole and Siberia.

Geographically the territory of Russia (and specifically Krasnoyarsk Territory) is optimally located along the shortest international air routes, including cross-polar routes from North America to the countries of southern and southeastern Asia via the North Pole. Modern equipment and technologies provide for the necessary safety conditions for regular passenger flights over the North Pole along the shortest possible routes.

I would like to outline the history of the project and the idea behind it.

1. The initiative on opening the shortest routes from North America to Southeast Asia was proclaimed at the Second International Economic Congress in St. Petersburg in 1997. In August the Krasnoyarsk-based airline Sibaviatrans made a demonstration flight along the following route: *Krasnoyarsk – Dikson – Spitsbergen – Greenland – Montreal – Washington* on the outbound leg and *Washington – Montreal – Edmonton – Cape Barrow – Khatanga – Krasnoyarsk* on the return. The official delegation on board the flight included V.M. Zubov, deputy chair of the Federation Council and governor of Krasnoyarsk Territory, and G.N. Zaitsev, director of the Russian Federal Aviation Service.

2. August 1997. Talks were held at the headquarters of the International Civil Aviation Organization (ICAO) in Montreal. During the negotiations, which included G.N. Zaitsev, ICAO President Assad Kotaite, and representatives of Canadian and U.S. airlines, the project received ICAO approval, and working groups were created to handle various aspects.

3. October 1997. By decree of Russian President B.N. Yeltsin, activities associated with creation of the cross-polar routes were initiated.

4. April 1998. A high-level coordinating group chaired by the ICAO president held a meeting in Moscow.

5. June 1998. The first nonstop demonstration flight with passengers on board was made by Cathay Pacific Airlines on the New York–Hong Kong route.

6. The Russian government officially opened international cross-polar routes.

7. 1998–1999. Approximately 60 test flights were made on cross-polar routes.

The project consists of the following stages:

- creation of an aircraft tracking system using shortwave and ultrashortwave frequency bands in the interests of the airlines (creation of the ACARS system)
- creation of a space-based communications system using satellites in highly elliptical orbit (HEO). Russia still maintains the necessary scientific-technical potential in this branch of the space industry and is presently the only country that uses HEO.
- creation of navigational, information, service infrastructure at airports and related facilities to serve the cross-polar flight traffic and ensure appropriate distribution of cargo shipments within Russia and abroad
- creation of Russian and joint airlines to implement regularly scheduled flights along cross-polar routes by aircraft based at Siberian airports
- creation of an infrastructure for airline operations (including modernization and construction of additional facilities for jet fuel production at refineries in Angarsk, Achinsk, and Omsk for refueling planes at Siberian airports)

Notwithstanding that the project is strategically important for Russia and has received support at all levels, its implementation began only in late 2000 because of a lack of real financing. The first part of the project, Creation and Subsequent Operation of the Russian Network for the Global ACARS System, began with the allocation of 15 million rubles from the Program for the Development of the Closed Administrative-Territorial Zone of Zheleznogorsk, which I mentioned earlier. Northern Air Bridge has recently entered into contracts with the American company ARINC, which operates the global system. Activities associated with equipment delivery are currently under way. Plans call for creating a segment of 8 stations (out of 40) with a central satellite communications station and a data processing and control center to be located in Zheleznogorsk. From there, information will be transmitted to the ARINC data processing center in Annapolis, Maryland.

I would like to reemphasize that the project is very important for Russia, since it facilitates the development of international services for the

use of airspace. Without the coordinated support of federal organizations, especially financial support, the project will be unable to proceed. Russia could then lose this market for aerospace industry services related to supporting cross-polar flights.

Next, I would like to review the most widespread problems encountered by the enterprises I have mentioned while carrying out their innovation projects.

- access to investments in the necessary amounts and for the necessary length of time (for the overwhelming majority of the innovation projects)
- the unstable economic and political situation in Russia and its regions
- the unstable nature of laws and regulations, especially with regard to taxation, and the frequently changing tax rates and collection procedures, which make it difficult to forecast expenses
- the extremely unfavorable conditions for obtaining loans for innovation projects in the Russian banking system:
  - ♦ high interest rates
  - ♦ lack of a system of investment bank lending on a long-term low-collateral basis
  - ♦ impossible collateral requirements for loans
- unattractiveness of Russia and its regions from an investment standpoint, which makes foreign investors extremely unwilling to invest in new spheres of activity, especially in the regions
- bureaucratization of the economy and resulting duplication and confusion regarding the authorities of the federal and regional executive-branch agencies, as well as the frequent changes that are made in their organizational structures. The need to obtain varied and numerous permits causes substantial difficulties in carrying out high-tech innovation projects, especially those that are new for Russia. Moreover, existing laws and regulations on these matters are often conflicting and ambiguous. Various federal agencies can be assigned the same authorities.
- imperfection (or practical absence) of laws and regulations that would facilitate prompt and efficient development and implementation of joint targeted programs at various levels (federal, regional, interregional, and local, especially in closed zones)
- undeveloped public utility infrastructure (particularly with regard to communications), especially in Siberia and the Russian north

In summary I would like to share my thoughts on the steps that must be taken to create a favorable climate for the development of innovation projects.

- Support for innovation activity must come primarily from the federal government at the state policy level. I am referring to the passage of the federal law and appropriate regulatory acts regarding innovation processes. Furthermore, I believe that such a package of legislation must not be of a merely declaratory character; it must create a real mechanism for implementing this policy.
- A targeted policy must be pursued to maintain and stimulate development of innovative technologies and products developed at city-forming enterprises. These projects must be developed individually but with the active participation of the base enterprises, including the provision of the necessary space, equipment, and specialists. I believe that this work must be done with the focused support and incentives of the industry's ministry (Minatom). As a start, Minatom could propose that specialists from the city-forming enterprises develop their ideas and mechanisms by spinning off innovative projects into separate independent businesses that could then form the basis for the appropriate legal acts and targeted programs.
- Support is needed from various structures—technoparks, technology incubators, science cities—to develop and promote linkages among innovation projects. Special preferential tax advantages need to be created for such structures.
- My next recommendation concerns sources of financing for innovation projects. I would suggest creating special innovation funds that would have rights as investors to participate in the implementation of projects. This plan should include a system of incentives and benefits for such financing organizations. Furthermore, existing resources could be used, namely the federal Program for the Development of Closed Administrative-Territorial Zones. Existing budget legislation places strict limits on the use of these funds, which makes it impossible to use them to finance innovation projects with long recoupment terms and increased risks regarding completion.

In conclusion I would like to note that despite the lack of favorable conditions for harnessing innovation potential, this process is beginning to gain momentum, as directly confirmed by the examples I have cited. A great deal depends on our efforts and on initiatives at the local level.

Steps Taken by the Zarechny City Administration to Support Small Innovative Companies

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The Zarechny City Administration launched its efforts to support small business, especially innovation-oriented small business, immediately after the city government was created and the city was reassigned to normal status within the oblast where it is located. At first, this activity was viewed as a way of diversifying the city's economy, a measure aimed at making the city less dependent on the monopolism of the nuclear power complex enterprises located in Zarechny.

The Russian economic situation at that time (1992–1994) facilitated support for and active development of small innovation-related businesses. As a result of liberalization, people gained opportunities for conducting independent business activity, which was previously forbidden by law and entailed criminal punishments. At the same time, the industrial crisis was just beginning. Enterprises were operating, the results of innovation activity were in demand, and customers were able to pay. Finally, the third important factor at that time was found in the practically complete absence (or nonenforcement) of laws dealing with intellectual property. For this reason, private individuals could make risk-free use of technologies as if they were their own property. These technologies had been developed at a real cost, often a very high one at that, and were owned by the enterprises and, in the end, by the state.

All of these factors brought about an innovation activity boom in cities with a high degree of technological potential. This was the case in the city of Zarechny in 1992–1994. The number of companies engaged

*Translated from the Russian by Kelly Robbins.

in innovation activity in the years at the peak of this phenomenon reached 300 in Zarechny. For instance, there were 10 small enterprises in the field of medical laser device manufacturing alone.

At that time, there appeared a multitude of intermediary promotional firms, firms that became involved in technology transfer and firms that offered engineering services. A long list of such firms could be compiled. However, the main point is that only a few of them survived. In his report on innovative firms, Yevgeny Loguntsev discussed the most illustrative individual cases and cited specific examples. The goal of my report is to provide more detailed information on the current situation regarding support for small business and especially innovation-oriented small business. Table 1 presents some basic information regarding business conditions in Zarechny in recent years.

The mid-1993 establishment of the Technopark, which was created to provide favorable conditions for entrepreneurial development and small business, can be considered to mark the beginning of business support

TABLE 1 Overall Picture of the Local Business Sector in Zarechny

	Year				
	1995	1996	1997	1998	1999
Population	32,000	32,900	32,400	33,000	33,100
Working population	19,200	19,400	19,800	19,800	19,900
Persons registered as involved in business activity, of which:	1,684	1,520	2,043	2,145	2,195
Individual entrepreneurs	1,260	1,081	1,611	1,708	1,750
Incorporated entities	424	439	432	437	445
Persons actively involved in operating small entreprises, of which:	419	462	510	516	545
Individual entrepreneurs	310	350	400	420	445
Incorporated entities, by industry:	109	112	110	96	100
Manufacturing			22	20	22
Construction			21	12	12
Retail trade			36	31	32
Other			31	33	34
Proportional share of small business in the municipal economy (in percentages)					
Workers employed			6.2	6.2	6.7
Volume of goods and services produced			1.5	2.5	2.75

efforts in Zarechny. Already in 1993 the first investment project competition was held, with the winners receiving preferential loans and tax benefits (specifically regarding local taxes). A small business support program is currently in operation at the Technopark. The rationale for the program is based on giving top priority to creating a favorable socioeconomic environment, constantly monitoring employment problems, and promoting the development of competitive high-tech business projects that will provide a rapid return on investment and facilitate the utilization of accumulated scientific-technical potential. The Technopark is the entity responsible for implementing the program, while the finance mechanism is provided by the Zarechny Technopolis Fund for the Support of Entrepreneurship and Small Business.

The closed joint-stock company Technopark is an organization with a branched structure that allows it to react efficiently to the needs of business structures. Figure 1 illustrates the structure for business support that had developed by late 1999.

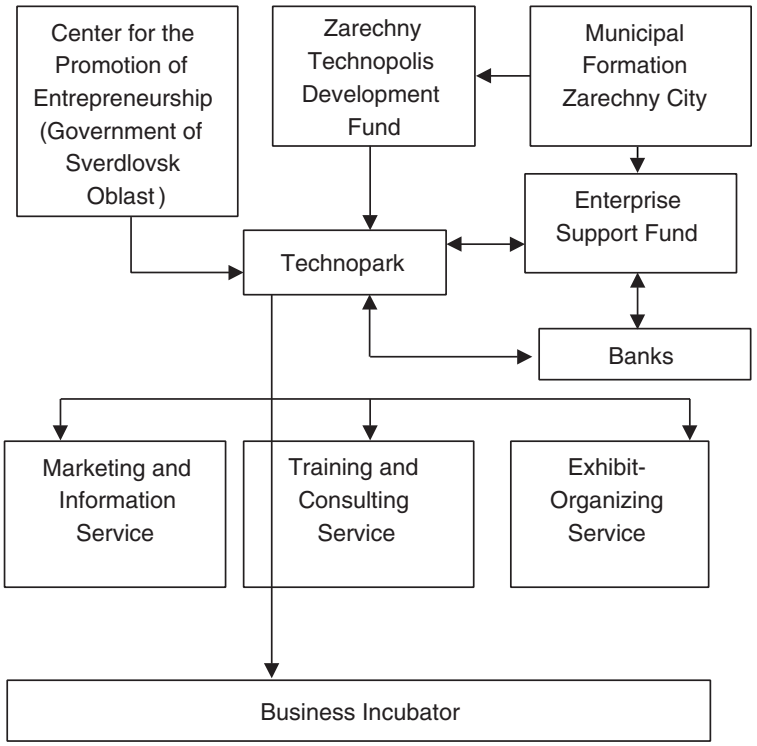

FIGURE 1 Business support structure in Zarechny.

This support structure and the activities it carries out cover the majority of fields involved in the support of business activity in Zarechny. Since the Technopark was established, volumes of investments attracted have grown from 105,000 rubles (1993) to 2.66 million rubles (1999) (see Table 2). These financing sources include the municipal budget, bank loans, funds from the employment center, the Sverdlovsk Oblast budget, reinvestments, local and outside nonbudget funds, and the federal budget. For the past two years, no funds have come from the federal budget or the employment center, as the share of private and nonbudgetary funds has sharply increased. To aid in strategic planning of business support activities, the market for services needed by entrepreneurs is constantly analyzed. Whereas financial and marketing services were in greatest demand at the initial stage of the support effort, entrepreneurs now also need engineering services, business incubators, venture capital advice, and consulting services.

Small business support activities are financed using various sources, including municipal and oblast budgets, grants from foreign foundations, repayable resources from commercial banks, the federal budget (federal investment tax credits), profits from the operational activities of the Technopark, and funds from the city and oblast employment centers.

All in all, the following results have been achieved through the implementation of business support measures:

- More than 600 individuals or entities were newly registered as being involved in small business.
- Some 3.7 million rubles in funding was attracted from various sources to support the program of actions.
- More than 30 business plans were financed.
- Favorable leasing terms and tax privileges were provided to 35 small businesses in accordance with existing regulations and based on Technopark agreements.
- A guarantee fund of 410,000 rubles was formed, which provided loan guarantees for 14 small businesses in the total amount of 2.03 million rubles.
- A micro-credit program is in operation and has granted 20 loans for a total of 150,000 rubles.
- A total of 3,000 hours of consulting services has been provided to entrepreneurs.

TABLE 2 Investment Trends in Zarechny by Year

	1993	1994	1995	1996	1997	1998	1999
Volume of investments (thousands of rubles)	105	220	365	450	660	1,005	2,660

- Fifteen short-term seminars have been conducted on various aspects of business activity, with more than 180 people taking part.

At the current stage of Zarechny's development, entrepreneurial structures have embraced all fields of activity, from services and retail trade to high-tech. Some of the brightest and most stable examples are the following:

- PGS works in the high-tech field. It manufactures test gas mixtures and ships them to industrial enterprises in the Siberian Urals region. The enterprise employs seven people, and its sales volume reached 2 million rubles in 1999. It was ranked among Russia's best enterprises in a competition marking the 10th anniversary of the rebirth of entrepreneurship in Russia.
- Diteks produces consumer goods, including creams and dyes for shoes and other leather goods. Today it is one of the leading manufacturers of these types of products in Russia.
- The Region-Spectrum Group successfully operates in the gasoline business, including various related services such as retail gasoline sales, food sales, and automotive service.

Despite the significant amount of work that has been done to support business development, conditions in the small business sector remain difficult because of the crisis situation in the Russian economy. Programmatic measures aimed at supporting small business should be aimed at minimizing negative external influences and reducing and smoothing over unfavorable factors that hinder business development.

Special attention needs to be paid to the development of small business, as it is this group of enterprises that is the most numerous. Furthermore, small business enterprises are the quickest both to react to changing economic conditions and to produce a return on investment. In addition, these enterprises do not require large financial investments inasmuch as they largely use their own funds or funds they have attracted themselves, thus taking all risks on themselves.

Two main aspects of stimulation for the development of small business may be highlighted: support for already existing private enterprises and creation of conditions for the creation of new ones. These two objectives are interconnected, as the successful functioning of small business enterprises is in and of itself a factor that stimulates the expansion of the ranks of such enterprises.

Measures to support private entrepreneurs and provide incentive for their participation in the city's development must take into account the special characteristics of this group of enterprises. Such firms are primarily characterized by the small volume of resources they possess. This state-

ment refers not only and not primarily to their financial resources. Small enterprises have few or no material resources and are always short of trained personnel.

Given this situation, measures to stimulate small business enterprises must compensate for these characteristics. This means that stimulus measures must include the following three components:

1. financial support
2. infrastructure support
3. personnel support

In each of these areas, plans must include actions that cannot be taken by the enterprises themselves but fall within the functions of the Technopark. Measures required for more successful operation in this sphere will be determined by the enterprises themselves.

Specific efforts to create favorable conditions for business development may be categorized as follows:

- financial support
- provision of a necessary range of services
- a system of benefits and preferences that can be customized as needed
- assistance with conversion and support for the development of science-intensive small business
- business incubation services
- management services
- engineering services

An analysis of the needs of business structures shows that primary needs are in the areas of consulting and marketing services, then financial services, and finally all other types of services (engineering, business incubators, venture capital advice, lobbying for business interests, information centers, exhibit centers).

In addition to various types of preferential lending and financing schemes, support for business also requires that the local authorities facilitate interactions with regulatory and monitoring agencies, such as the sanitary-epidemiological service, fire department, retail trade department, and sanitation inspectorate. Furthermore, consulting services by lawyers, accountants, and business incorporation specialists would also be useful (to be provided on preferential terms).

The specific nature of small business in the innovation sphere is reflected in more active support in the special selection of just such types of projects and organizations. For this purpose, special efforts were made in 1999–2000 to create a city business incubator. The incubator was assigned

unused space belonging to the Zarechny branch of the Research and Development Institute of Power Engineering (NIKIET). This space was a separate building with auxiliary facilities, which by joint decision of Minatom and the Zarechny City Administration was officially declared city property for the purpose of creating an incubator for small innovative businesses. The administration leased the space (about 3,000 square meters) to the Technopark to provide for the city innovation infrastructure. Small enterprises are currently being settled in the incubator, and the city administration has established favorable terms for the leasing of these premises.

The administration has made serious efforts to support small science-intensive businesses by using the investment tax credit mechanism. The administration received this credit against budget funds in 1996 and 1997. A portion of the credit amounting to 500,000 rubles was specially designated for the support of small enterprises. In particular, the credit was used to support the previously mentioned enterprises PGS and Diteks. At present, all of these projects have been successfully completed, and the funds are being repaid in accordance with the agreed terms.

The administration has recently launched another form of support for small innovative businesses. Entitled Business Incubator 2, this project is aimed at preparing a well-equipped site for new manufacturing facilities. In cooperation with the organization that will carry out the project, the administration is grading the site and doing preliminary design work on putting in the necessary infrastructure. A competition will subsequently be held to select the small enterprises who will have their production facilities constructed on the site, with these firms to cooperate in the design, construction, and operation of the facilities. The organization implementing the project (the board of directors of Incubator 2) is providing services related to the operation of the entire complex and is working to attract new partners to locate their facilities at the site.

Incubator 2 differs from the existing incubator in that it assists enterprises that have already gained strength and are capable of furthering their own development but lack the resources to do it alone. The role of the city administration in this project is limited to coordinating and initiating the joining together of those involved. The Incubator 2 project essentially represents the continuation of the Incubator project, as it will support entrepreneurs who have outgrown the conditions provided by the small-scale initial incubator.

Two things made it possible for this project to be carried out in Zarechny. First, there has been a certain improvement in the economic situation, including in Zarechny, which has led to the appearance of wholly successful small businesses that are experiencing a need to develop. This is true not only in retail trade-related spheres of activity, but also in the manufacturing sector. Second, the experience gained through

the operation of the existing incubator has been positive, as have the results of many years of effort aimed at supporting small business.

Another area where the administration is working in cooperation with the development fund involves the establishment of wide-scale venture capital activity in conjunction with the creation of a regional innovation center to serve the research institutions of the Urals Branch of the Russian Academy of Sciences and Minatom enterprises operating in the Urals region. The government of Sverdlovsk Oblast is actively participating in this effort through the involvement of its Science and Technology Administration. This entire effort is included as a project in the proposed Program for the Development of Zarechny as a Science City. The regional innovation center project is already being carried out and will continue regardless of the decision on granting Zarechny the status of a Russian Science City. Zarechny has a great need for this project, as the center will allow and is now allowing the city to become the site for promising science-intensive production facilities. The oblast government and the institutes of the Urals Branch of the Academy of Sciences also have a great need for it, as it will allow them to use a ready-made innovation infrastructure at minimal cost to themselves.

Experience in working with the small business sector has been taken into account in the current operating strategy of the administration. The first conclusion made as a result of many years of experience concerns the effectiveness of supporting powerful people and projects and the ineffectiveness of supporting weak ones. In accordance with this conclusion, the decision was made to implement the Incubator 2 project. The need for uncovering potentially powerful people and projects and revealing their potential to the maximum possible extent represent the strategic consequences of this conclusion. Therefore, plans for the Program for the Development of Zarechny as a Science City include the Personnel Bank project, which is aimed at finding potentially promising entrepreneurs and managers and providing them with additional training. This project is now being prepared for implementation. In addition to these strategic objectives, our traditional small business support efforts remain in effect, as discussed previously.

Regarding additional measures that would be effective at the oblast and federal levels, the most important point to highlight would be the creation of conditions for providing municipalities with incentives for the economically efficient activities of small business. To achieve this, it would be sufficient to include in the Law on the Budget a provision by which all tax revenues from small- and medium-sized businesses would go directly to local government budgets. At the oblast level the government should adopt documents defining the development of the innovation infrastructure. It would be ideal if the oblast would pass a law on innovation activ-

ity and adopt an oblast-level program for developing innovation activity, including a special component on infrastructure development.

The experience amassed in the creation of science cities requires separate consideration. It appears that the effective utilization of science cities as innovation centers requires more active involvement of cities in this effort, as well as stricter monitoring of the results and effectiveness of investments.

The Role of Foreign Partners as Investors or Customers in the Development of Small Innovative Businesses in Snezhinsk

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Opportunities for restructuring science-intensive industry in Russia largely depend on the efficient operation of the innovation chain from scientific idea to industrial technology to production of goods that can attract solvent customers. For a number of objective and subjective reasons, this chain is now broken in Russia.

At the very beginning of the country's economic transition to market relations, great hopes were pinned on possibilities for using the scientific and technical achievements of Soviet science and science-intensive industry in order to attract major investments. These expectations were based on well-founded high estimations of the scientific and technical potential of the USSR and on the immense resource investments that had been made in the scientific-technical sector of the economy (primarily in the military-industrial complex and related spheres in both the Academy of Sciences system and higher education).

Today it can be stated that all of these expectations have led to practically nothing. In fact, there has been a brain drain of relevant specialists to the United States, Europe, and other countries. Counterpart investments have generally been connected with the raw materials industries and the service sphere, with minimal use of Russia's intellectual potential. There have been practically no investments in the scientific-technical sector. The main reason lies in the fact that this sector was arranged in an absolutely non-market-oriented manner and actively resisted any possible changes.

[*] Translated from the Russian by Kelly Robbins.

Major industrial enterprises categorically refused to change their organizational structures, management systems, and technological cycles, and as a result their products could not compete with foreign analogues in terms of price and quality. Despite the enormous number of brilliant scientific ideas that have been generated in research institutions, there were no promising technologies or developments that could be quickly produced and marketed in product form. As for the small businesses that emerged in the late 1980s and early 1990s, they were generally structures without their own facilities and equipment, completely dependent on their landlords.

In recent years, Russian entrepreneurs have gained a much better understanding of the requirements of potential investors and have made more sober assessments of their proposals and capabilities. But unfortunately, along with greater understanding of the situation among potential participants in the investment process, new problems have appeared in all segments of the innovation chain. Material resources have been exhausted, equipment has become outdated, facilities have fallen into disrepair, and financial reserves have been completely drained. The technological foundation laid in Soviet times was largely exhausted (some ideas and developments became obsolete, while the developers of others either emigrated or shifted to different sectors of the economy), with very weak efforts being made to restore and augment it.

Regarding Snezhinsk, at first all activities concerned with international relations were generally concentrated at the city-forming enterprise. The main reason for this could be found in the special regime and the undeveloped city infrastructure, which in the past mainly fulfilled the function of supporting the operations of the city-forming enterprise. In the early 1990s the city became responsible for social issues, public utilities, and other matters, and a growing number of enterprises involving private capital began to appear, with most of them providing intermediary or retail and wholesale trade services.

Only recently has some progress been seen in the development of small businesses using conversion technologies and developments. This process has been facilitated by the city administration's policies in support of new production facilities and by the substantial increase in the number of entrepreneurs owing to job cuts at the city's main enterprise. The period from 1998 through 2000 saw the appearance of a new source of investments in innovation-oriented business in Snezhinsk, namely foreign investments. The Nuclear Cities Initiative (NCI) is the main investor in Snezhinsk in this sphere.

A program for the accelerated creation of new jobs in Snezhinsk has been established under NCI auspices.

Table 1 provides brief information on projects proposed for implementation under the NCI framework in accordance with Article 2 of the agreement.

TABLE 1 Proposed Projects

Project	Required Funding (thousands of dollars) Total	2001	2002	2003	2004	2005	Number of jobs
Open computer center							120
Creation of a pharmaceutical packaging facility (project cost: $360,000)		300					90
Development of telecommunications (project cost: $185,000)		120					20
Mechanical unit		90					12
Processing of semiprecious and precious stones		150					10
Development of bar-coding technologies		275					150
Positron tomography (PET) center	1500						50
Production of autonomous heating systems using Uran boilers (project cost: $592,000)	150						100
Production of quick-to-assemble residential buildings (project cost: $1,107,000)	400						250
Production of high temperature furnaces and heating elements	75						12
Production of equipment for enhancing the mobility of the disabled	120						24
Production of thermoplastics and disposable dishes (project cost: $270,000)	150						20
Snezhinsk Energy-saving Company (project cost: $600,000)	600						60
Production of air purification systems (project cost: $200,000)	200						20
Construction of box factory							350
Production of polymer asphalt-concrete mixtures (project cost: $3,000,000)	500						30
Installation of automated unit for producing emulsified asphalt (project cost: $360,000)	100						15

TABLE 1 *(continued)*

Project	Required Funding (thousands of dollars) Total	2001	2002	2003	2004	2005	Number of jobs
Production of metal-plastic pipes (project cost: $4,650,000)	2600						50
Design work on transport packing casks	200						35
Development of city telephone network							135
Production of radiation-resistant optic fibers	700						40
Water-jet cutting technology for decorative stone processing	250						10
TOTAL							1,603

One example that can be cited is the Spectrum-Conversion Research and Production Enterprise, a limited liability company. Its founders are the Snezhinsk City Administration and various private individuals. Its primary activities involve developing and manufacturing conversion-oriented products.

- **Design of prosthetic legs.** In every country there is an urgent demand for prosthetic equipment. In the United States alone, there are 260,000 disabled persons who have had one or both legs amputated, and this figure increases by 40,000 annually. These disabilities cost a billion dollars annually just to provide for the initial needs of the patients. The problem is even more urgent in the countries of the Commonwealth of Independent States than it is in the United States. Funding has been provided by the Initiatives for Proliferation Prevention (IPP) program of the U.S. Department of Energy (DOE) and by the National Center for Medical Rehabilitation Research (NCMRR) of the U.S. National Institutes of Health (NIH).
- **High-temperature furnace and heating elements.** The All-Russian Scientific-Research Institute of Technical Physics (VNIITF) has developed expertise in designing and manufacturing high-temperature furnaces and related heating elements. Personnel with such skills are continuing this work with Spectrum-Conversion, and the company plans to commercialize these developments.
- **Processing of semiprecious and precious stones.** There is an enormous amount of low-grade ore that includes stones similar to precious and semiprecious stones used in jewelry. Spectrum-Conversion has demonstrated its ability to select and improve the quality of some of these

stones. They have developed processes that include appropriate temperature, pressure, vacuum, and atmosphere (various gases) needed to increase the value of the stones (for example, by increasing the brightness or changing the color from dark to light). This process produces an attractive increase in the value of the stones. For instance, unprocessed cubic zirconium stones initially costing $1 per carat could be sold at a price of $30 per carat after processing. The first stage of the project will involve the processing and sale of perfected stones. The second stage will entail obtaining a safety license for the processing of such precious stones as sapphires and low-grade emeralds (grade 3). The second stage will also include the training of four people in stone cutting and polishing.

- **Production of automobile parts jointly with Kirkham Motorsports and the Kansas City Plant.**
- **Commercial development of bar-coding technologies.** The enterprise Identification Technologies Company (ITECH), which was founded in 2000 under an agreement between the City Administration and Oak Ridge Laboratory, also obtained assistance from NCI. The enterprise supplies the Russian market with identification equipment produced by such American companies as InfoSight Corporation and Telesis for the marking of various products.

The first General Agreement under NCI, # 17B-99380V, was signed between the Snezhinsk City Administration and Oak Ridge National Laboratory on January 25, 2000, for more than $2 million. Creation of the company was based on the following objectives:

- distribution and installation of advanced technologies for automated accounting of materials and products at enterprises in the region and around the country as a whole
- creation of additional jobs in the city on this basis

Plans called for these objectives to be pursued in three stages. In the first stage, the main emphasis was on selecting foreign partners that produced the equipment the region needed for the marking and automated identification of materials. The necessary dealership or representation agreements were to be signed regarding the delivery of the required equipment and materials. This stage also included training sales and service personnel, conducting market research studies and an advertising campaign, and establishing contacts with potential customers.

In the second stage, plans called for focusing on the creation of conditions for guaranteed after-sales service of installed equipment. The production facilities were to be developed, and staff members from client organizations were to be trained on operating and maintaining the purchased equipment.

In the third stage, the production of certain types of equipment was to be established onsite. The number of people employed at the enterprise was to reach 150 by the time this stage was completed.

At present, almost all tasks planned for the first stage have been fulfilled. The necessary agreements have been signed with a number of leading U.S. producers of identification technologies (Intermec, Telesis, InfoSight, Hersh). An advertising campaign was launched in the Urals region. Company personnel are being trained at the headquarters of the equipment producers.

- **Organization of production of Uran heating boilers.** This project involves the organization of serial production of autonomous heating systems based on Uran boilers. In the initial stage, plans call for producing 10-kW–1,000-kW heating boilers that will operate on natural gas or liquid fuel. The anticipated output will be 1,250 200-kW boilers per year. The system includes a boiler, fuel burner device, automatic safety and control system, circulation pump, and offset thermostat regulator (for small-power boilers).
- **Municipal Internet infrastructure and new opportunities for business.** This project includes the creation of a municipal Internet infrastructure that will link city organizations by means of a computer network. The approximate cost of the project is $200,000. The new municipal Internet infrastructure will produce the following positive results:

  - ♦ It will preserve jobs or create new ones at enterprises selling and installing computer and communications equipment.
  - ♦ It will create a new sector of the job market in Snezhinsk: Internet design and software companies, electronic business, news services, and library and consulting services.
  - ♦ It will make it possible to move forward on projects with Oracle (creation of a centralized municipal data storage facility) and Lucent Technologies (sale of equipment for the telecommunications sector).

Besides the international programs, commercial relations with foreign partners in the innovation business sector are developing extremely poorly, if not worse. Initial experience has been accumulated by Diapason, which began actively working with Chinese enterprises in 1992. Diapason was founded by private individuals in the aim of profiting from the implementation of scientific-technical projects in the area of environmental protection. To commercialize its developments, the company began shipping tractors to China. As payment for the equipment, the company received shipments of consumer goods, which were then sold in the Urals region. The company operated successfully from 1992 to 1995. The company invested part of the profits from its commercial activity into the

promotion of its developments. Agreements to create new scientific-technical products were signed and implemented with companies from Snezhinsk, Chelyabinsk, and Yekaterinburg. The imposition of new customs legislation made shipments to China unprofitable. The company redirected its efforts to the Russian market, but the market situation made it impossible to invest considerable funds in promoting and organizing production of the new developments. As a result, Diapason ceased active operations in 1995.

SnezhinskTechService is another enterprise that has worked with foreign partners. For a long time this company has specialized in producing nipple watering systems of its own design for poultry farms. In addition, the company designs and sells equipment and provides services for high-capacity transformer diagnostics. Last year, SnezhinskTechService signed a contract with a firm from the United Arab Emirates in the amount of $30,000. Under this contract, the company supplies watering systems to enterprises in Uzbekistan. To date, only $8,000 has been paid on the contract.

An 18-month epic in the initiative of cooperation with the University of New Mexico technoparks program in fact brought no results for the Russian side. All appropriated funds were used in the United States. As a result, no response has been received on any of the joint projects that were discussed.

Another enterprise, Pulse, tried to obtain support from NCI for its project involving the development of automated portable cardiographs for use in telemedicine. Negotiations have been held, and the project was discussed at the telemedicine session of the international meeting on medical research issues (September 24–27, 2001). The project was included as a top-priority element of the medical section of the Snezhinsk accelerated conversion plan, but it has nevertheless remained only on paper.

A positive example of cooperation with foreign partners should also be mentioned. With the active support of the Foundation for Russian-American Economic Cooperation and the U.S. Department of Energy, the Snezhinsk City Administration established the Snezhinsk International Development Center (IDC) Foundation in 2000. We would like to note that the foundation was involved in joint efforts to organize the exhibition High Technologies of the Defense Complex 2001, which was held in Moscow at the Expocenter on Krasnaya Presnya. More than 300 enterprises from 22 Russian regions and Commonwealth of Independent States (CIS) countries took part. The closed administrative-territorial zones were represented by two cities, Snezhinsk and Tryokhgorny. Six enterprises represented Snezhinsk: Avangard, Home, Bars-70, SnezhinskTechService, Spectrum-Conversion, and VNIITF. The extremely high status of the forum led to high attendance, which gave the Snezhinsk enterprises a

good opportunity for seeking partners and customers, advertising and promoting their products, and conducting related market research.

An analysis of the current situation indicates that

- Owing to the lack of resources, attempts by project initiators to finance commercialization at their own expense do not lead to the creation of efficient businesses. There are few chances for obtaining loans because of the high risks associated with innovation activity without any financial support.
- Participation in various joint programs is currently the most realistic way of attracting foreign partners in the innovation-oriented small business sector.
- Unfortunately, a certain degree of success has been achieved to date only in cases involving the funding of state- or city-owned enterprises. This can be explained by the following reasons:

♦ Risk. Investments in private enterprises are more risky if they are not backed with guarantees from the city administration or city-forming enterprise. However, private Western capital also has no intentions of relying on state or municipal enterprises.

♦ Varying objectives. The primary goal of the city administration is to create or preserve jobs in order to address the employment problem, which corresponds to the missions of most programs that provide support. The goal of private entrepreneurs is to create and develop an efficient business that makes a profit. However, striving to create a significant number of jobs without considering business efficiency itself often leads to the appearance of "investment-addicted" companies that perish as soon as investment "injections" cease.

- The effectiveness of support programs is reduced by existing restrictions and barriers, namely

♦ As a rule, the amount of support provided for a particular area is not enough to commercialize innovations. Most of the funds remain in the territory of the foreign partner.

♦ Discussion and coordination of a list of projects proposed for funding require a long period of time (up to several years). This substantially decreases the appeal of such support, especially for innovative businesses, because the life spans of competitive advantages in the market are not lengthy.

♦ Projects are being carefully worked out and subjected to expert evaluation of their economic viability and efficiency. In most cases a project represents merely an application for funding rather than a real business plan. Issues connected with the demand for future products or

services in the market are often poorly considered. In submitting a business idea for consideration, project initiators proceed from the available capabilities of a particular enterprise or region and not from market demand. In other words, they are trying to produce what they can, but not what consumers will buy.

♦ There is a lack of full supervision of the project, including regular assessments of the efficiency of investments.

• There is a lack of expertise in management and an absence of communication skills in dealing with foreign partners.

Steps Taken by the Sarov City Administration and Most Important Organizations in Support of Small Innovative Businesses

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INTRODUCTION

The city of Sarov is one of the leading defense centers of Russia, with its economy being largely based on the Russian Federal Nuclear Center All-Russian Scientific-Research Center of Experimental Physics (VNIIEF) and the Avangard Electromechanical Plant. For more than half a century, the city has accumulated the research and production potential needed to handle the most challenging scientific-technical tasks involved in developing, manufacturing, and testing various types of nuclear weapons.

Cutbacks in defense-related work at VNIIEF and Avangard over the past decade have brought about a need to intensify civilian-oriented activities. However, growth in this area has not been as fast as expected. This has occurred for two reasons: (1) the insufficient funding of defense conversion from the federal budget and (2) the continuing low number of solvent customers for high-tech products in Russia. As a result, the accumulated scientific-technical potential of local collectives is not being used to its full capacity, and there is a constant threat of layoffs. This is a point of concern for the population because of the limited opportunities for finding alternative jobs for a large number of specialists.

[*] Translated from the Russian by Kelly Robbins.

Solving these problems requires attracting investments to new conversion-oriented production enterprises. The Sarov City Administration and the management of the city-forming enterprises—VNIIEF and Avangard—are working to support conversion enterprises by means of several targeted programs. The measures included in these programs are aimed at achieving a number of goals, namely,

- creating and developing conversion-oriented production facilities
- increasing output volumes for high-tech and science-intensive civilian products and commercializing technological developments
- expanding job opportunities for employees displaced from the defense sector
- creating a favorable business climate to aid in attracting investments

To achieve these goals, the following objectives should be addressed:

- stabilizing and creating conditions for the city's economic development
- modernizing existing production facilities and creating new ones in the civilian sector
- ensuring employment for the population and creating new jobs
- improving and developing the production and innovation infrastructure
- preserving and developing the social infrastructure

This report covers the activities of the Sarov City Administration and the management of the city-forming enterprises in support of small innovative businesses and conversion-oriented production facilities. It cites data on investments and describes the concept of the Innovative Technology Center being established in the city as a key element in the innovation infrastructure.

TAX PRIVILEGES GRANTED BY THE CITY ADMINISTRATION TO SMALL INNOVATIVE FIRMS

The Sarov City Duma grants certain taxation privileges to enterprises and other institutional taxpayers having community development-oriented investment projects and owing no tax debts as of the date of filing their tax declarations. This action is taken to provide incentives for business activity, attract additional funds on the revenue side of the Sarov city budget, preserve existing jobs and create new ones, and implement welfare programs in the Sarov closed administrative zone. The privileges are granted in accordance with the provisions of Articles 1 and 56 of the

Russian Federation Tax Code; Paragraph 3, Article 64 of the Budget Code; Paragraph 3, Part 1, Article 5 of Russian Federation Law 3297-1 On Closed Administrative-Territorial Zones, dated July 14, 1992 (revised version, Law 67-FZ, dated April 2, 1999); Article 52 of Law 150-FZ On the Federal Budget for 2001, dated December 27, 2000; and Articles 2, 5, and 6 of Law 2116-1 On Profits Taxes for Enterprises and Organizations, dated December 27, 1991 (revised version, Law 118-FZ, dated August 5, 2000). The privileges granted are the following:

- Profits taxes are reduced by 90 percent of the rate normally paid to the city of Sarov.
- Property taxes are reduced by 100 percent of the rate normally paid to the city of Sarov.

ATTRACTING INVESTMENTS FOR SMALL INNOVATIVE FIRMS FROM THE CITY, MINATOM, AND INTERNATIONAL FOUNDATIONS

Defense conversion projects are typically funded from several sources. Funding sources and amounts are shown in Table 1.

Following are brief descriptions of the projects being implemented that have managed to attract investments.

Pilot Projects of the Innovative Technology Center

Project goal: developing design documentation and test samples of high-tech equipment under several pilot projects and seeking orders and potentially promising contracts. Basic products include

- functional models and test samples of original machines and devices for widely varied applications
- design and technology development work in response to technical specifications provided by outside customers
- refinement of manufacturing technologies and production of test samples of high-tech equipment using customer-provided design documentation

Potential customers: domestic and foreign manufacturing enterprises, design organizations, and tuning companies.

Economic and social indicators: planned annual turnover, $500,000 to $3 million, depending on type of orders; expected number of jobs, 10–15 full-time with the possibility of hiring additional personnel (up to 200 individuals) for work on each specific order; total project financing, $430,000; payback time: four years.

TABLE 1 Projects Financed (in millions of rubles)

Project title	Total Investments	Minatom	Federal Budget	Fund for Development of Conversion Companies	NCI programs
Pilot projects of Innovative Technology Center	12.0	—	—	6.0	6.0
Design and start-up of serial production of high-voltage switches with SF_6 insulation	140.0	90.0	—	20.0	30.0
Development, testing, and production of sensors, devices, and systems for automated control of technological processes at fuel and energy enterprises	27.0	10.83	—	10.17	6.0
Development of a diamond processing facility	72.0	51.5	10	10.5	—
Start-up of small serial production of high-voltage formation devices	2.8	1.4	—	1.4	—
Production of depleted zinc oxide isotopes	185.6	178.1	—	7.5	—
Establishment of Energy Conservation Center	2.16	—	—	2.16	—
Start-up of serial production of super-light and light aircraft	4.04	—	—	4.04	—
Production of special tanks for highly pure substances	0.98	—	—	0.98	—
Establishment of shop to produce current conductors	2.4	—	—	2.4	—
Production of intrusion indicator devices (*)	0.45	—	—	0.45	—
Start-up of serial production of movable units for ultrasonic rail defect detectors (*)	1.04	—	—	1.04	—
Development of an industrial model of a ^{238}Pu-based heat source for remote space applications (*)	1.6	—	—	1.6	—
Start-up of production of disposable dishes (*)	1.24	—	—	1.24	—
Start-up of serial production of force gear controls for city passenger transport vehicles (*)	18.4	17.5	—	0.9	—

NOTE: Projects marked with (*) are carried out at the Avangard plant.

Start-up of Serial Production of High-Voltage Switches with SF_6 Insulation

Project goal: organizing a conversion enterprise to develop and manufacture high-voltage electrical devices with SF_6 insulation. The project proposes to create the following products and services:

- scientific-technical documentation on high-voltage switches with SF_6 insulation
- 110-kW circuit breaker switches with SF_6 insulation
- 6(10)-kW switches with SF_6 insulation
- autonomous hydraulic lines for self-compressing 110-, 220-, 330-, and 550-kW switches with SF_6 insulation
- distributor device with SF_6 insulation
- mobile gas equipment for manufacturing and assembly work on switches with SF_6 insulation

Potential customers: Unified Energy Systems of Russia, Rosenergoatom, Tsentrenergo, Mosenergo, Dalenergo, Kolenergo, and others.

Economic and social indicators: total number of jobs to be created over the course of the project, 2,700 (100 in Year 1, 400 in Year 2, 700 in Year 3, 750 in Year 4, and another 750 in Year 5).

Project implementation period: 2001–2003.

Start-up of Production of Mechanical Vibration Sensors for Use in Compressor Station Gas-Pumping Units and Other Equipment for the Energy Industry

Project goal: organizing serial production of technological vibration sensors and units for fuel and energy industry enterprises according to designs created by the VNIIEF-VolgoGaz Research and Production Association.

Potential customers: Gazprom.

Economic and social indicators: total project cost, 10,174,000 rubles; new jobs to be created during project implementation, 20.

Project implementation period: 1998–2001.

Diamond Processing Factory

Project goal: creating a diamond-cutting and jewelry manufacturing factory based on effective processing of natural raw diamonds for applications in jewelry, medicine, electronics, and precision devices.

Potential customers: 80–90 percent for export and 10–20 percent for the domestic market.

Economic and social indicators: output of diamonds in 2000, 5,000 carats, or 111.2 million rubles; expected output in 2002, 24,500 thousand carats, or 565.95 million rubles; expected output in 2005, 59,000 carats, or 1.3629 billion rubles. Anticipated number of employees once full capacity is reached, 320.

Project implementation period: 1999–2004.

Start-up of Small-Scale Production of High-Voltage Forming Devices

Project goal: organizing a facility to produce high-voltage forming devices for ignition systems of ZMZ 406 series motors.

Potential customers: ZMZ plant, retail trade network.

Economic and social indicators: total project cost, 2.8 million rubles; new jobs created, 90.

Project implementation period: 1998–2002.

Creation of a Plant to Produce Depleted Zinc Oxide Isotopes

Project goal: expanding existing VNIIEF centrifuge production capabilities to make depleted zinc oxide isotopes for applications at nuclear power plants.

Potential customers: nuclear power plants with boiling water reactors. The potential market is concentrated in several highly developed countries, primarily the United States, Japan, Sweden, and Germany.

Economic and social indicators: total project cost, $6.4 million.

Project implementation period: 1998–2003.

Establishment of Energy Conservation Center

Project goal: implementing energy efficiency projects, creating automated power consumption monitoring systems, and rendering services related to energy audits and electrical system changes.

Project description: The Energy Conservation Center will make it possible to provide the industrial enterprises of Sarov with modern energy-saving tools and then expand these practices to other regions. Automated systems for the accounting, control, and management of energy use in the public utilities sphere can be introduced in the operations of management agencies of the city administration. This will give city and regional management agencies and enterprise managers access to reliable analytical information on efficient energy consumption (energy audit).

Potential customers: Ministry of Fuel and Energy, oblast and city governments.

Economic and social indicators: total project cost, 2.16 million rubles; jobs created, 16.

Project implementation period: 1998–2000.

Start-up of Serial Production of Super-Light and Light Aircraft

Project goal: producing and marketing super-light and light aircraft for professional applications.

Potential customers: airlines from Commonwealth of Independent States (CIS) and other foreign countries, excursion and tourism organizations, agricultural enterprises, Ministry of Health, Ministry of Emergency Situations, Ministry of Defense, Ministry of Internal Affairs, Unified Power Systems of Russia, Gazprom, research organizations, flight training schools, amateur flying clubs.

Economic and social indicators: total project cost, 4.04 million rubles; jobs created, 16.

Project implementation period: 1999–2004.

Production of Special Tanks for Very Pure Substances

Project goal: developing a unified technological process from the purchase of precursor materials to the production of tanks to the sales of the end product to the consumer.

Project description: During 1999–2000, VNIIEF worked in a focused manner to create special tanks and accessories (valves, gas reducing gears, etc.) to be made from stainless steel intended for such purposes. As a result, the technology for manufacturing tanks with a capacity of up to 40 liters was developed and refined. The tanks have a working pressure of up to 300 bars with high-quality internal surfaces that contact the substances stored. The design features that were developed make it possible to eliminate the main problems typically found in tanks manufactured with traditional technologies both domestically and abroad.

Potential customers: microelectronics industry enterprises, fiber optics manufacturers, producers of very pure substances, including Minatom enterprises, metrology organizations, and Gazprom.

Economic and social indicators: total project cost, 975,000 rubles; jobs created, 19.

Project implementation period: 2000–2003.

Creation of a Shop to Produce Current Conductors

Project goal: launching serial production of current conductors.

Project description: Plans call for using explosive welding to join all types of metals and alloys along entire contact surfaces regardless of the configuration and size of the parts involved.

Potential customers: nonferrous metallurgical enterprises, a number of foreign firms (Finland, Chile, Canada, Kazakhstan).

Economic and social indicators: total project cost, 2.4 million rubles; jobs created, 18.

Project implementation period: 2000–2005.

Production of Tampering and Intrusion Indicator Devices

Project goal: launching production of originally designed tampering and intrusion indicator devices using the production capabilities of the Avangard plant.

Project description: Activities and consultations at Minatom enterprises have shown the need to improve the current system for sealing containers and the like. The main aspect of the new sealing program at Minatom enterprises will be the introduction of new seal types with improved characteristics.

Potential customers: According to a market analysis conducted by specialists from Rosenergoatom and VNIIEF, it can be confidently expected that Minatom enterprises and other organizations would purchase the indicator devices to be produced by the new TechnoControl firm. In particular the Ministry for Railway Communications, banks, and law enforcement agencies have also expressed interest.

Economic and social indicators: total project cost, 450,000 rubles; jobs created, 12.

Project implementation period: 1999–2002.

Start-up of Serial Production of Mobile Units for Ultrasonic Detection of Rail Defects

Project goal: modernizing the serially produced POISK-10E rail defect detector and developing computer-aided tools for rail defect detection in order to upgrade the reliability of railway diagnostics and facilitate long-term forecasting of rail conditions.

Potential customers: Russian Federation Ministry for Railway Communications.

Economic and social indicators: total project cost, 1.04 million rubles; jobs created, about 50.

Project implementation period: 1999–2001.

Development of an Industrial Sample of a ^{238}Pu Heat Source for Remote Space Applications

Project goal: developing an industrial sample of a ^{238}Pu radionuclide heat source for remote spacecraft applications.

Potential customers: S.A. Lavochkin Research and Production Association, Russian Academy of Sciences Institute of Space Research.

Economic and social indicators: total project cost, 1.6 million rubles; jobs preserved, about 23.

Project implementation period: 1998–2001.

Start-up of Production of Disposable Dishware

Project goal: establishing the production of disposable dishware (tea and coffee spoons, forks, knives, coffee cups, other plastic cups).

Potential customers: wholesale and retail traders.

Economic and social indicators: total project cost, 1.24 million rubles; jobs created, 49.

Project implementation period: 1999–2001.

Start-up of Serial Production of Force Gear Controls for City Passenger Transport

Project goal: launching production of electronic devices providing for enhanced reliability of the electrical components of subway cars.

Potential customers: Dinamo (Moscow), MetroVagonMash Plant (Mytyshi), subway systems.

Economic and social indicators: total project cost, 890,000 rubles; jobs created, 60.

Project implementation period: 1998–2001.

ESTABLISHMENT OF THE INNOVATIVE TECHNOLOGY CENTER: A STEP IN AIDING SMALL INNOVATIVE FIRMS

Several years ago, VNIIEF, Minatom, and the Sarov City Administration jointly founded the open joint-stock company VNIIEF-Conversion. The goal of creating this subsidiary was to set up a holding company that would manage defense conversion projects that had matured enough to operate as independent legal entities. At present the holding company manages 10 broadly diversified affiliated companies and monitors the implementation of other conversion projects that have received loans from the Fund for the Development of Conversion Companies. In cooperation with the VNIIEF Investments Department, VNIIEF-Conversion is involved in developing an information-analytical system that will facilitate monitoring of the financial condition of the various projects.

The creation of the Innovative Technology Center (ITC) marks a new stage in the development of VNIIEF-Conversion. Relying on technologies available at VNIIEF, the ITC will have a specialized infrastructure designed for facilitating the creation, growth, and development of newly

emerging companies. It will also stimulate innovation activity in the city of Sarov, facilitate cooperation between researchers and industry, provide services to science-intensive companies in information support and management training, and accelerate real economic development based on creating regional and international networks for information exchange and cooperation among firms.

Much is already being done in this regard. VNIIEF-Conversion in involved in the Russian Marketing Network and is a coauthor of a Tacis project proposal on establishing a connection to the European information network. The economic and legal departments of VNIIEF-Conversion also provide consulting services, and the company collaborates with the Sarov Branch of the LINK International Institute of Management, which provides training in management and innovation. In 2000 LINK provided professional training on the commercialization of research results for 25 VNIIEF and Avangard employees involved in International Science and Technology Center (ISTC) projects. In 2001 the Sarov Branch of LINK is working with the University of South Carolina to fulfill a contract funded by the Nuclear Cities Initiative (NCI) to train 40 managers and specialists involved in conversion projects at VNIIEF and the Avangard plant.

At present the ITC is still in the process of being established under the auspices of VNIIEF-Conversion. The ITC concept has not yet been fully refined, and the technical audit of small innovative firms is not yet complete. Another Tacis project developed in cooperation with the Lahti Regional Educational Consortium (Finland) is devoted to accomplishing these tasks. The expected outcome of this project will be a development plan for ITC that will allow it to offer a comprehensive package of services to the small innovative firms that will be its clients. A very widespread problem in the first stage of ITC's development has been the very limited range of services that is offered, that is, secretarial services, reception and mailing of postal correspondence, word processing, and telephone answering services, among others. The goal of the Tacis project will be to provide a rather full range of services from the moment that ITC's building is ready for full operation, as well as to create a positive public image for the ITC by ensuring that expectations are met. We hope the ITC will avoid the destiny of a company that trades unrealistic ideas.

Activities of the Obninsk City Administration Aimed at Supporting Small Innovative Firms

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Obninsk City Administration

CURRENT STATE OF SMALL- AND MEDIUM-SIZED ENTERPRISES IN OBNINSK

A total of 3,937 small businesses are registered in the city of Obninsk, accounting for 85 percent of the total number of all registered enterprises and organizations. The number of small enterprises that are actually operating is 1,228. The principal types of activities in which these firms are involved may be broken down as follows:

- Some 17 percent are involved in manufacturing, including the high-tech sector.
- A total of 11 percent are engaged in construction work.
- About 3 percent provide transportation and communications services.
- More than 40 percent are involved in retail or wholesale trade or food service.

The small businesses of the city employ about 19,000 people, or 38 percent of the total working population. The charter-defined activities of 350 small firms (10 percent of all such enterprises) involve the scientific-technical innovation sphere. The number of small companies actually operating in the high-tech innovation area can be estimated as approximately 30 to 40. About 42 percent of all income from the sale of goods and services is earned by small businesses, and these enterprises provide about 30 percent of all city budget revenues.

[*] Translated from the Russian by Kelly Robbins.

INFRASTRUCTURE FOR SMALL BUSINESS SUPPORT IN OBNINSK

The existing city system for the support and development of small business includes a number of structures capable of rendering a wide range of services. Obviously there are also other structures in the city that support start-up companies. The organizations that I mention here are those that belong to the Regional Innovative Technology Center (RITC) consortium. RITC enterprises cover practically the whole range of city needs for innovation services. Any missing elements will be created or strengthened in the future. In particular this can be done using funds from the Obninsk science city program.

In addition the Obninsk Center for Science and Technology (OCST) has been established by the Obninsk City Administration and all city research institutes to assist in integrating the capabilities and efforts of the institutes on matters regarding technology commercialization. The center also helps resolve similar problems for small enterprises, including by representing their abilities at various exhibitions within the framework of unified citywide displays. It should be noted that creation of the innovation infrastructure is one of the key elements of the Program for the Development of Obninsk as a Science City. This process is aimed at developing the existing infrastructure, creating new elements, and integrating them into a unified and coordinated system for innovation activity support.

Meanwhile, the Obninsk Chamber of Commerce, which has a cooperative agreement with the city administration, lobbies for the interests of business and promotes the development of the business support infrastructure, thus fulfilling its primary ideological objective of serving as a link between entrepreneurs and the city authorities. Near-term plans call for establishing a system under the chamber's auspices for representing the interests of small innovative firms and integrating their public affairs activities.

ACTIVITIES OF THE CITY ADMINISTRATION IN SUPPORT OF SMALL INNOVATIVE BUSINESSES

First of all, I would like to note that all city administration activities in support of small innovative businesses were undertaken by the previous team, which was headed by former Mayor Mikhail Vladimirovich Shubin.

Credit and Financial Support

In November 1992 the Fund for the Support of Small Business was established by the city administration. According to the Federal Law on

State Support for Small Business in the Russian Federation, the fund is a nonprofit organization that provides funding to implement city administration policies in the area of business support and development.

The Obninsk City Administration is the founder of the fund, the main objective of which involves financing projects for small business in Obninsk. This financing is made in the form of loans of up to 250,000 rubles for up to one year at annual interest rates of 10–15 percent. Over the past nine years, more than 90 projects have been financed for a total of more than 3.5 million rubles.

The fund can render support both by direct credit in the form of preferential loans and by guarantees provided at the time the recipient obtains credit through another lending institution. In this manner the fund provides a guarantee if the borrower lacks sufficient collateral. To date, the fund has already provided four such loan guarantees. The practice of giving guarantees has recently been successfully introduced in collaboration with Sberbank. In 1999, three guarantees were given to the Obninsk branch of Sberbank for project loans, including to enterprises in the scientific-technical sphere.

Preferential loans are the most common way in which the fund provides financial support. While the average interest rate for loans in Obninsk banks is 25–30 percent, the fund grants loans at 10–15 percent. The lowest rate is applied for projects in which the funds are to be used for industrial development and equipment purchases as well as projects of high social and innovation significance. Preferential loans are granted both on a competitive basis and in the course of normal operational activity. Competitions are held at least twice a year. The last was held in August 2001, with four projects receiving financial support in the total amount of 850,000 rubles.

Unfortunately the city cannot afford to invest directly in high-tech production projects, no matter how significant they may be to us. In particular the city administration's Fund for the Support of Small Business is currently stepping back from the practice of operating as a financial structure. The reorganization of the fund is intended to create a guarantee fund that would provide collateral for bank loans granted to projects on a competitive basis. In addition the fund is expanding its activities in providing various types of consulting and information support services to small companies. Such support for enterprises is the most effective and is becoming a regular element of the existing infrastructure for investment activities.

To make our city truly attractive for investments, we are using our main advantages, namely our highly qualified labor force and its intellectual potential, innovation opportunities primarily in high-tech products, and the availability of the principal institutions of the market economy. However, the imperfection of the current Russian tax system is hindering

active investment activity. At the same time, effective development of the manufacturing and innovation spheres is impossible without creating favorable conditions for attracting investments. This task is one of the most important in the Program for the Development of Obninsk as a Science City. It involves a number of measures for the support of investment activity to be undertaken at the city level, specifically in the area of providing appropriate laws and regulations.

Legal and Regulatory Support for Small Business

Temporary Resolutions on Support for Investment Activity and on the Investment Council

The Program for the Development of Obninsk as a Science City includes measures aimed at developing legal and regulatory documents determining procedures for investment activity and outlining a system of incentives and guarantees for investments in Obninsk. In conjunction with these measures, the Resolution on Support for Investment Activity in the City of Obninsk was adopted. It establishes tax benefits for legal entities that invest in the development and expansion of their own enterprises and create new jobs. The tax burden on these enterprises is cut almost in half by exempting them from taxes paid directly to the local government. However, under the new Russian Tax Code that went into effect on January 1, 2001, the tax for housing stock maintenance and the social infrastructure as well as the value added tax are no longer considered local taxes. Therefore, the city can no longer create incentives in the form of exemptions on these particular taxes.

The Obninsk Investment Council was formed as another element of the development program. Chaired by the mayor, its membership includes representatives from the public and private sectors of the economy. The investment council was established in 1999 to develop and implement investment policy in the city. It makes decisions on granting tax incentives according to the Temporary Resolution on Support for Investment Activity and supervises implementation of city investment projects and application of incentives for investors. Three main areas of the investment council's activities should be specially noted in addition to those listed in the resolution: marketing and promoting the city, developing the technology for working with investors, and taking measures to improve the business image of the city. Obninsk actively strives to establish good business contacts at all levels. This is illustrated by constant visits by foreign guests and representatives of Russian business circles; by the special attitude towards Obninsk taken by various foundations, in particular the Eurasia Foundation; and by the support provided to Obninsk by the Tacis Program.

As previously mentioned, when the second part of the new tax code and a number of laws on taxes and revenues went into effect on January 1, 2001, the value-added tax and the tax for housing stock and social infrastructure were no longer considered local taxes. Therefore, the city could no longer institute preferential rates or exemptions on these taxes. As a result, changes were made in the Resolution on Support for Investment Activity. The resolution might now be somewhat less attractive to enterprises, although preferential rates are still in effect for certain substantial taxes, including property tax and income tax. In addition, as a result of elections, the city leadership changed in March 2001. The composition of the investment council is therefore under review, with the new membership expected to be confirmed by the Obninsk City Council and begin work in the near future.

Other Legal and Regulatory Documents

At present, efforts are being made under the auspices of the program to improve city laws and regulations regarding land use and construction. A decision was made to prepare sites for construction and determine their necessary technical parameters. Potential investors will be able to inspect the sites to determine their attractiveness. Resolving issues connected with real estate and other property will represent another incentive in attracting investors.

Support for Small Innovative Enterprises Under the Comprehensive Small Business Support Program

In 1998 the city administration together with the Chamber of Commerce and a number of innovation infrastructure companies developed the Small Business Support Program in Obninsk. The program was largely oriented to the priorities of the Program for the Development of Obninsk as a Science City, which was being developed at that time. Therefore, once the Science City Program was launched, there was no further need for the Small Business Support Program, and its planned activities were taken over by the Science City Program.

RESULTS OF CITY GOVERNMENT SUPPORT FOR SMALL INNOVATIVE BUSINESSES

Results of Legal and Regulatory Affairs Support

In accordance with the Temporary Resolution on Support for Investment Activity and the decision of the Investment Council of Obninsk, tax agreements were concluded with three city companies in 2000. Two of the

companies are currently making use of the agreements, while the third enterprise is just starting its operations and will receive the tax benefits as soon as it receives investment capital.

Example

The support given to the Rastr-Technology company can be considered successful, although the incentives themselves did not play a significant role in the company's expansion and development. The enterprise's success was due to its long and painstaking work with its partner and the scrupulous fulfillment of its commitments. As a result, in the initial phase of project implementation, the enterprise already saw its cash flow significantly exceeding planned levels. However, it was the city administration's policy of supporting small innovative businesses, its efforts to assist firms, and its favorable attitude towards business development that attracted Rastr-Technology to Obninsk. The example of this firm shows that Obninsk's status as a science city ("intelligent" business, a highly-skilled workforce) plays a substantial role in attracting small business and investments to the city.

Successes

- Rastr-Technology works in cooperation with the large state enterprise Technology in replacing foreign nonmetallic materials with Russian ones in the production of forms for the packaging and printing industries, thus taking advantage of the scientific and industrial potential of Obninsk.
- By using its experience in developing packaging materials, including those intended for use with unique made-to-order scientific instruments, the company facilitates small shipments for other local firms, which in turn helps these firms get their products to the market, as packaging plays one of the key roles in product promotion.
- The company chose to locate in Obninsk because of its science city status, as well as the possibility of hiring highly qualified specialists and the availability of tax incentives. The company provides staff development opportunities, attracts young workers, and keeps people from leaving the city for jobs elsewhere. At any given time, Rastr-Technology hosts five or six students from Obninsk universities for practical training and internships.

Problems Currently Faced by the Enterprise

- High import duties for technological equipment
- Customs delays in importing raw materials and other supplies from abroad, leading to delays in filling orders

- Complete lack of state support regarding product exports to nearby countries (including members of the Commonwealth of Independent States)

The company is currently striving to find customers in Ukraine, Uzbekistan, Kazakhstan, and the Baltic states. It surpasses its competitors from Germany, Poland, the Czech Republic, and Turkey in the time it takes to fill orders (orders are executed within a week). However, customs procedures then take three weeks, nullifying the enterprise's competitive advantages. Unfortunately the city administration cannot provide effective help with such issues. To a certain extent the problems have been eased by cooperation with the firm's foreign partner, which has a better understanding of the problems than the federal government.

Results of Credit and Financial Support

Inasmuch as the main problems were caused by the shortage of circulating capital in the Fund for the Support of Small Business, the city administration focused its efforts on increasing the amount of such funds available. A total of 850,000 rubles were obtained from the Program for the Development of Obninsk as a Science City under the program component entitled "Development of the Fund for the Support of Small Business, Augmentation of Turnover Funds, and Creation of a Collateral Fund." Owing to the increase in its assets, the fund can grant larger sums to projects and for longer periods. A competition for investment projects was held in July–August 2001, and the fund's credit committee recently selected the winning projects to be supported. The size of the loans offered this time was four times higher than in the last competition, with each of the projects selected receiving 200,000 rubles for one year.

At present the fund has assets of 700,000 rubles, which are used for operating activity. Together with additional funds from the Science City Program, the fund's total assets exceed 1.5 million rubles. With these assets, the fund serves as a guarantor for loans obtained from commercial lending institutions. Thus, a solid foundation has been established for the creation of a guarantee fund, which will facilitate the attraction of nongovernmental funds for project financing. A successful example of collaboration along these lines already exists in the form of efforts involving Sberbank.

Example

In 1998–1999, the Obninsk branch of the Kaluga division of Sberbank provided credit to the Eridan-1 Science and Technology Center, a limited liability company. Sberbank initially provided the credit for export orders. Later on (in 2000–2001), after the enterprise had established a credit history, further loans were made for the firm's innovation project

on trace gas analyzers. The project involves developing, certifying, and launching small-scale industrial production of new environmental monitoring devices.

The Fund for the Support of Small Business played the deciding role in securing approval for the first credits from Sberbank, as it served as a guarantor for the enterprise and risked its own assets. Thanks to these loans, Eridan-1 was able to complete the very complex and highly technical work needed to fill six contracts with customers from South Korea, China, Portugal, and Kyrgyzstan.

Successes

The project for production of gas-analyzing devices was successfully completed, and a small batch of finished products was manufactured. The characteristics of the devices are unique and the best in the world. State product quality testing was successfully completed, and procedures for equipment certification were developed. The total sum of Sberbank loans was 7 million rubles, which Eridan-1 is currently repaying.

Problems Currently Faced by the Enterprise

Eridan-1 is encountering two main difficulties hindering the further development of export shipments as well as efforts on the trace gas analyzer project:

1. All loans are given for a short term, only one year. It is very hard to carry out a lengthy innovation project with such a short time limit.
2. The rate of interest on the loans is rather high, so they can be repaid only if the project is very profitable.

RESULTS OF THE CITY ADMINISTRATION'S ACTIVITIES AIMED AT SUPPORTING SMALL INNOVATIVE BUSINESSES

Successes

- Thanks to the assistance of the city administration, a diversified infrastructure for the support of small high-tech businesses has been created in Obninsk. The city is a cofounder of a number of innovation infrastructure enterprises (OCST, the Obninsk Regional Agency for the Promotion of Investment and Technology [RAPIT], the Technopark, the Fund for the Support of Small Business).
- Judging from the experience of the Fund for the Support of Small Business, the lack of coordination in business support efforts represents a substantial obstacle to the city administration in implementing its sup-

port measures. But without this support, entrepreneurs would face great difficulties and costly mistakes and losses in overcoming the administrative barriers along the path from enterprise establishment to the production of finished goods. As a result of the creation of the RITC consortium, which united the enterprises making up the innovation infrastructure, the problem related to lack of coordination has been overcome.

- Plans for the Obninsk City Development Program included a package of 104 investment proposals at various stages of preparation and implementation. These proposals formed the basis for the creation of the city portfolio of investment projects.
- As a result of the measures taken by the city administration to build the city's image, Obninsk has become an attractive relocation site for small innovative businesses based elsewhere. Enterprises are eager to be registered in the Science City of Obninsk, thus attracting investments to the city, keeping qualified personnel employed, augmenting the tax base, and creating good new jobs for city residents.
- Business management has improved substantially. Until recently, many leaders of small high-tech companies lacked knowledge and skills in business planning, despite their high level of academic achievement. Thanks to the activities of the city administration, the Franco-Russian Institute of Business Administration (FRIDAS), the Fund for the Support of Small Business, other institutions, and foreign specialists, a number of workshops and consultations were organized and have produced positive results.
- Owing to implementation of the Program for the Development of Obninsk as a Science City, the circulating capital of the fund was significantly increased, making it possible to provide increased financing for investment projects selected on a competitive basis. The situation has been fundamentally changed, as the main "sore point" for the Obninsk business sector was the unavailability of loans and investments, as revealed by the activities of the city Fund for the Support of Small Business. Most entrepreneurs need sums of 200,000 to 300,000 rubles for a term of more than one year.
- The initial experience of the Fund for the Support of Small Business in working with Sberbank on loan guarantees has shown that such activities are promising. Bankers are favorably inclined to work with the city administration, as its guarantees on loans carry substantial weight. In the future the administration plans to put even greater emphasis on attracting nongovernmental funds for loans to small innovative companies. Plans call for the guarantee fund to increase to 2 million rubles in the next year.

Failures

- Unfortunately there has been no spark of interest among entrepreneurs in the opportunities offered by the Temporary Resolution on Support for Investment Activity, despite the fact that this resolution played

the most important role in creating favorable conditions for business development in the city. It seems that one important reason why entrepreneurs have viewed the resolution unenthusiastically lies in its requirement that information about their business activities must be open to the city authorities. Furthermore, a survey of members of the business community has revealed that 84 percent of respondents have never heard of the resolution, and the 15 percent who are aware of it are rather skeptical. One-third of those questioned do not believe that the tax benefits set forth in the resolution will be a real incentive for business development and for the attraction of investments to the city. By the way, such skepticism is often caused by the lack of information about the Temporary Resolution. All in all, many entrepreneurs are simply not aware of the business support opportunities offered by the city administration.

- The capabilities of the city administration for supporting small business by granting tax incentives were substantially decreased if not eliminated by the recent changes in Russian tax legislation. It is now possible that the Temporary Resolution will not be able to play an important role in the support of small business.
- Due to a lack of funds, the city administration has been unable to fully implement all possible types of credit and financial support. This primarily affects start-up companies with no liquid assets that could be used as collateral for bank loans. To obtain instruments or equipment that could then be sold or used as collateral, a company needs credit so it can convert its ideas or patents into state-certified devices, equipment, or technological processes. On the other hand, banks have no right to lend money without collateral, which start-up innovative companies generally lack. Thus, the enterprise finds itself in a vicious circle.
- The problem of finding available space for small innovative companies (especially within the city limits) has not yet been overcome. Private businesses are not eager to be placed on state-owned property because there is no possibility for them to buy the facility later. Meanwhile, there is a catastrophic shortage of available municipal space in the city. The reason for this situation lies in the fact that Obninsk was founded as a "nuclear city," and almost all its territory belonged to the various state research institutes.

PROSPECTS FOR THE DEVELOPMENT OF SMALL INNOVATIVE BUSINESSES IN OBNINSK

Long-Range Plans of the City Administration for the Support of Small Innovative Businesses

These plans are defined in the Program for the Development of Obninsk as a Science City, the entire strategy of which is of course devoted to

supporting innovative business. The concept of Obninsk as a science city has been based from the beginning on the idea of promoting the stable development of the city on the basis of high-tech resources. Bringing the results of scientific and technological research into fruition in the form of manufactured products will give the city a good footing in the marketplace and help to increase revenues for the city budget. It is this sort of innovation model at which the Program for the Development of Obninsk as a Science City is aimed. To implement the model, conditions are being created for the development of high-tech enterprises as outlined in subprograms 2, 3, and 5 of the program.

Subprogram 2 is designed to develop the innovation infrastructure, one important element of which involves the creation of a business incubator. During the course of this project, facilities will be remodeled for use as office and manufacturing space by small innovative firms on the basis of five-year leases on favorable terms. For the first year the rent will be 50 percent of the standard municipal price; for the second year, 70 percent; for the third year, 80 percent; and for the fourth and the fifth years, 100 percent. The premises will be fully outfitted with everything necessary, from office equipment to specialized machine tools—everything will be provided as a complete package to the small innovative enterprises. A competition for placement in the business incubator was recently concluded, so the facility will begin operating shortly. However, the business incubator is only the first step in the development of the enterprise. Its further growth will inevitably be hindered by the lack of space for high-tech production facilities in the city. The empty space at our research institutes unfortunately cannot be used, as these facilities are federal property. The idea of launching production under the state's "roof" does not appeal to the managers of small innovative enterprises, as they inevitably encounter problems with property rights that are unregulated in the existing legislation.

Therefore, our main objective now is to build our own production facilities, connect them with the appropriate public utility networks, and provide enterprises with the space they need to launch high-tech production along with the possibility of buying these facilities later on. These goals represent the focus of our projects on creating a technopark and a municipal industrial zone.

The technopark project calls for the construction of an industrial complex under the auspices of the Science City Program and using program funds. It is designed so that enterprises that have outgrown the business incubator can lease municipal space where they can grow to maturity. The city will own the engineering networks, utility lines, and 1,400-square meter industrial complex at the technopark. Space will be leased on a competitive basis to the most promising science-intensive enterprises that have graduated from the incubator. The enterprises that have gathered

steam and are preparing to expand production will then move from the technopark to the municipal industrial zone. In contrast to the technopark, this zone will have no standing production shops—the firms will have to construct everything they need except the public utility lines, which will be provided as in the technopark. In general the technopark is a component of the municipal industrial zone, which has been assigned a 50-hectare site located around the 102-kilometer marker on the Moscow-Kiev rail line.

Thus, there is a simple but effective chain of assistance from the business incubator to the technopark to the municipal industrial zone. The first one prepares the start-up enterprise, the second provides ready production facilities after the enterprise has had some time to get on its feet, and the third provides land for the establishment of serial production.

PROPOSED SUPPORT ACTIVITIES

The situation in the high-tech business sector developed in such a way that in the early 1990s, investors were attracted only by short-term projects because of the extremely high inflation rate. However, the innovation business requires long-term investments with a high degree of risk. Nevertheless, high-tech production is, at the same time, among the most profitable of all types of business, so interest in it has increased noticeably of late. A great number of institutions have recently been created to support the high-tech business sector, including different agencies, technoparks, business innovation centers, and business incubators. Such a comprehensive innovation infrastructure provides effective support for innovative businesses, but only in those locations where the innovation business itself is highly developed—namely the major scientific industrial centers, such as Moscow, St. Petersburg, Kazan, Novosibirsk, and Samara. A paradoxical situation has been created in Obninsk: The innovation infrastructure is much better developed than the high-tech production sphere this infrastructure is intended to serve. The reason for this situation lies in the fact that opportunities for investment support for science-intensive enterprises are much greater in the major cities. Obninsk, like other science cities, lacks the financial potential that would make it possible to organize broad and systemic support for small innovative businesses. However, in my opinion, Obninsk can serve as an example of real attempts to organize such activity. What then is necessary to support science cities in the development of small innovative businesses?

Creation of a Material Infrastructure

As mentioned previously, the quest for available space is one of the main issues that arise in organizing the production of high-tech goods. At

the same time, a large amount of space is sitting empty at research institutes. Some of this space is being rented to innovative enterprises. However, it is understandable that the heads of these institutes prefer renting space to highly profitable manufacturing firms instead of innovative enterprises that face a long and difficult stage of getting up to speed. The state system of preferential terms for the rental of institute facilities to small innovative enterprises could serve as a substantial stimulus to the development of high-tech production. There is still a complete absence of federal regulations on the rental of empty facilities by research institutes. On the other hand, laws and regulations on the transfer of such facilities to municipal ownership are also lacking.

After the need for finding space, the second problem for small innovative enterprises involves the acquisition of equipment. Purchasing equipment requires loans, which are difficult to "work off" in the initial stage of production. Meanwhile, equipment leasing could provide a way out of the situation. However, Russia lacks a system for leasing machine tools, equipment, and measuring instruments. I believe that efforts to resolve this problem can be made at the regional level. For example, the government of Kaluga Oblast and the Obninsk City Administration could jointly establish an institution that would buy unused equipment from enterprises and then lease it to small innovative companies at reduced rates.

Investment Support

There is still no investment mechanism in our country. Our first attempt in this regard was undertaken at the oblast level. We presented the Kaluga Oblast Legislative Assembly with a project calling for the oblast government to provide investment guarantees. However, given the extremely risky nature of investments in the innovation business, the Kaluga Oblast government refused for understandable reasons. Moreover, private investors will not accept the project either, even on the condition that they would own all present and future research results of the enterprise. Consequently, a system is needed for insuring the risks of such investments, and this system must be under the auspices of the federal government, as no bank would undertake to finance such insurance.

According to international business practices, high-tech investments are made through venture funds. The creation of such a fund was initially proposed as part of the Science City Program. Using venture financing, we intended to develop a mechanism for bringing inventions to the market. This process involves scientific research, design work, and the manufacture of test samples. However, there is currently no law on venture financing. Meanwhile, using our own funds by way of an experiment, we could develop a model for the operation of such a fund, which could

serve as the basis for the passage of a Russian law on venture financing. Efforts to develop this model should include specialists from the Ministry of Economics and the Ministry of Science. After all, this is necessary for the entire country, not just our city. Nevertheless, we are applying our own efforts to push this idea through. We are currently planning to develop a draft resolution on venture financing and submit it to the federal government with a request that we be allowed to implement it in Obninsk within the framework of our development program.

Training of Specialists

In recent years, enterprise managers have been striving to acquire new business skills. Not long ago, businessmen refused offers to participate in seminars and training courses with the response "I know how to do business." But now, business management training services are in great demand, including training services oriented to the needs of high-tech businesses. Businessmen have also changed their approach to staff recruitment, with the main criterion no longer being based on family ties, but on the educational level and skills of the employee. However, high-quality training is costly, and as a rule, businessmen feel the costs are unnecessary. A system for providing professional training in high-tech business management can only be organized with state support. Obninsk can provide an example of the efficient organization of this kind of training. Under the auspices of the Nuclear Cities Initiative project, a training center is currently being created in Obninsk to train managers of high-tech companies. Established with the participation of the Obninsk Institute of Nuclear Power Engineering, the Franco-Russian Institute of Business Administration, and the Minatom Central Institute for the Improvement of Professional Skills, this training center could offer educational services to high-tech business specialists from all the nuclear cities.

Infrastructure Support

Despite the well-developed nature of the innovation infrastructure network, the services it offers are too expensive for the majority of innovative start-up companies. A system is needed for providing innovation-related services on a reduced-fee basis, including business planning, personnel training, research management, marketing, and patent services. At the city level, we are already working to resolve this problem under the Science City Program. However, a state system of support in this field is needed. Furthermore, it is necessary to bring order to the organization and financing of efforts to establish business incubators.

Resolution of Intellectual Property Issues

The intellectual property question remains unresolved at the federal level, which means that the owners of such property are not completely free to dispose of it as they see fit. Many of our small innovative enterprises got their starts within the walls of research institutes. However, the intellectual property that formed the basis for their activities was created using federal funds. While this question would not have been so controversial five years ago, today the institutes are unwilling to give their research results to private businesses. It is completely understandable that our institutes take such a position, as they must be compensated as organizational developers for the alienation of their intellectual property. Meanwhile, the technology cannot be developed, improved, or implemented without the small innovative enterprises that use it. Consequently, the first thing that is needed is a mechanism for providing research institutes with incentives for transferring technologies to private businesses. Second, conditions must be created so that intellectual property valuation is accessible to the majority of inventors. For this purpose, the regulatory basis for such valuations must be developed in appropriate form, and a system for training licensed evaluators must be established.

Support for High-Tech Product Exports

Commercializing our scientific achievements in foreign markets is of great significance in solving the problem of maintaining Russia's enormous scientific-technical potential. To sharply increase the export of high-tech services, equipment, instruments, licenses, and patents, scientists need favorable financial conditions for exports. The state could provide Sberbank with the guarantees for loans on export contracts with documentary letters of credit. These loans would be collateral-free, as scientists do not generally have the appropriate assets. All high-tech services rendered to foreign customers should be exempt from the value-added tax.

Purely bureaucratic obstacles represent an enormous hindrance in export-related activities, with the arbitrariness and incompetence of customs officials being especially troublesome. Customs documentation regarding the export of instruments and equipment should be minimized, and customs activity in general should be strictly regulated.

Small Business and the Macro Economy: Some Observations

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The general economic environment is critical for understanding the prospects of small business in any country, including Russia. In this presentation I will discuss the recent evolution of the Russian economy and comment on how it might be expected to develop in the years ahead. But before doing that, I will make a couple of observations about the nature and role of small business in market economies.

SMALL BUSINESS IN THE ECONOMY

Observation 1: Although the small business sector is undeniably a vital part of a modern market economy, it is not the core of such an economy. More importantly, small businesses cannot and should not be expected to "save the economy," not even a local economy, much less a national economy.

The United States has perhaps the largest small business sector of the Western advanced economies. There, in the 1990s, small business accounted for approximately half of total private-sector employment and output. Yet, even in the United States, small businesses play an auxiliary role. Or, more correctly, they play multiple auxiliary roles, as they do in all countries. Those roles differ depending on the state of evolution of the economy and its overall health.

In a thriving economy, small businesses represent the most dynamic, innovative, and risk-taking sector. In a declining economy, or simply one that has low living standards, small businesses are a survival, or coping, mechanism. These are not mutually exclusive roles; the two types of small

business will be observed in all economies. But the relative shares of the two types differ.

One feature that both the innovative and the survival-oriented small businesses share is that they are highly mobile. Small businesses are easier to establish than large businesses, and they are easier to shut down. (In economists' jargon, "entry" and "exit" are easier for small businesses.) They can more easily shift their orientation in terms of the market they target or the products and services they produce.

Because of this flexibility, small businesses allow individuals (the entrepreneurs) to take advantage of better opportunities as well as to cope with a risky, unpredictable environment. In the United States in the prosperous decade of the 1990s, small businesses accounted for 75 percent of net new jobs—a share that is larger than their share of total employment. In a recession, we can expect small business to account for a disproportionate share of job losses. The message is: Small businesses are more volatile. They grow faster, but they also die faster.

Every year in the 1990s, about 10 percent of U.S. small businesses went out of existence. (This represented about half a million firms each year.) But only about 10 percent of the firms that shut down business actually went bankrupt. The other 90 percent were voluntary shutdowns. Moreover, when asked about the reasons for closing the business, the majority of firm owners responded that their businesses were successful at the time they shut them down. Why, then, did they close? The answer has to do with the economist's notion of "opportunity cost": the owners judged that the resources that were being used in the old business, even when it was successful, could be used even more profitably somewhere else.

Small businesses do not determine the state of the economy as much as they reflect it. They are, in particular, very dependent on the institutions of a modern market economy. For instance, 75 percent of American small businesses obtained credit from outside. In other words, their health depended on the health of the financial system.

Small businesses in the United States also depend on a healthy government budget, since they are part of the federal contracting and procurement system. No less than 28 percent of federal contracts went to small businesses. While this is less than their share of the private sector (which, recall, is about 50 percent), it underscores the way in which small businesses are integrated into and dependent upon the overall economy.

Observation 2: While small business cannot save the entire economy, there are specific tasks the small business sector can help solve. Policy towards small business should not be based on exaggerated expectations but rather on clearly defined and realistic goals.

As stated above, the roles that small business plays in an economy are varied. They range from helping citizens to cope under conditions of

economic hardship, at one extreme, to the development of high-tech world-class industries, at the other extreme. Depending on a country's situation, those roles can both be important and deserving of support. Different policies will be necessary to help them fulfill those different roles.

It is important to have a strategic view of the country's economic development in order to decide on specific policies towards small businesses. Knowing the prospects for the general economic climate is critical. Policies to promote small businesses to solve any economic task beyond using them as mere survival mechanisms will be costly, in the short and middle term. The availability of resources depends on the overall economy. Let us now then turn to the picture of Russia's economy now and what might be expected in the months ahead.

A BRIEF REVIEW

The Russian economy has seen extraordinary changes in the past three years. After the government's default on its domestic debt in August 1998 and the subsequent paralysis of its payments system, output plunged to the lowest levels ever in a disastrous decade. But by the beginning of 1999, a strong rebound had begun. For one full year, the economy showed not just steady, but accelerating growth. Gross domestic project (GDP) growth rates reached a peak of 10–12 percent on an annualized basis in late 1999.

Since then, the economy's performance has become more moderate. Although it is natural that the economic rebound would gradually attenuate, and although the balance is still positive, there are some worrisome signs. This year, some major sectors of industry have even begun to show declines in output, in profits, and in investment. It is a good time to pause and ask what is it that has happened to the Russian economy after 1998. And what can be expected over the longer term?

Figures 1 through 3 give a snapshot of the economy from early 1998 through mid-2001. They use a few selected official Russian government statistical series to illustrate the production side as well as the welfare side. The figures are based on monthly statistics for year-to-year growth or decline. To smooth out temporary fluctuations and better show the trends, they are presented in the form of six-month rolling averages. In other words, each data point is the mean of the values for the preceding six months. For instance, the data point for June 1998 represents the average values for January through June, July's value is the average of February through July, and so on. (Smoothing the data in this way not only permits us to discern actual trends more clearly; it also helps minimize the measurement and reporting errors that plague Russian statistics.)

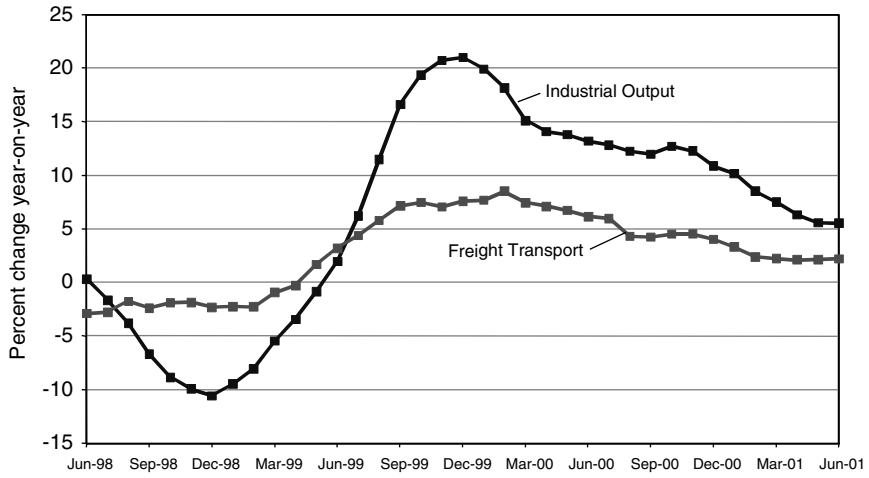

FIGURE 1 Industry and transport.

Figure 1 focuses on the production side. The two curves show industrial output and freight transport—both measured in physical units. Although the industrial output measure is more volatile, the two data series show the same general pattern: They were negative in 1998 (even before the August financial collapse); they rebounded strongly in 1999; and finally, they tapered off in 2000 and 2001, while still so far remaining positive.

Figure 2 shows some of the follow-on effects of the trends in the production sphere. It looks at household incomes and capital investment.

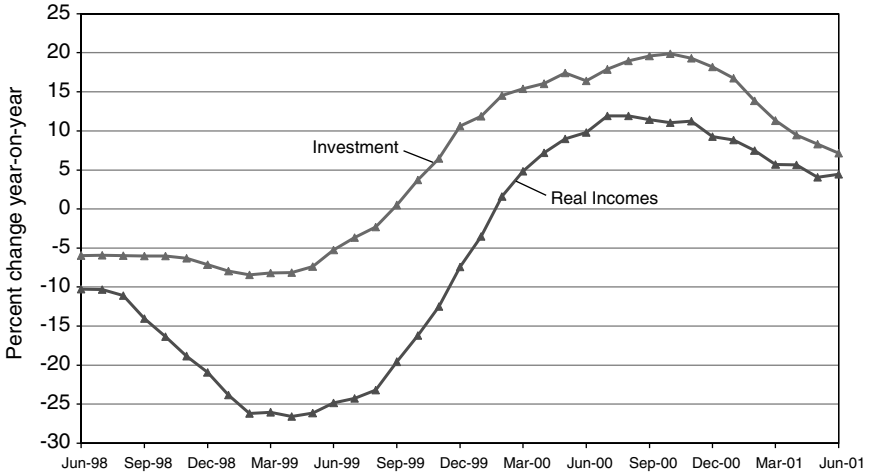

FIGURE 2 Investment and incomes.

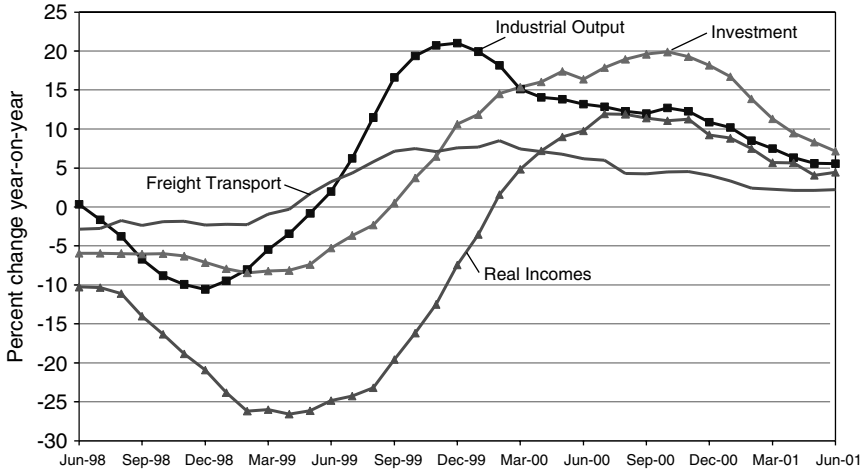

FIGURE 3 Comprehensive presentation of economic indicators.

Note that the pattern is the same as in the production measures: decline, rebound to ever-higher growth rates, and tapering off. As would be expected, there is a difference in timing—a six-month to one-year lag—as compared to the first figure. This becomes clearer when we superimpose the two charts and look at the four indices together (Figure 3). Despite the variation in volatility and in the timing over the entire three-year period, there is in the end a kind of convergence. So far, all four indices remain positive.

ACCOUNTING FOR GROWTH

There are two principal explanations for the patterns shown by these curves. The first is the increase in world oil prices. The second is the depreciation of the Russian ruble relative to the dollar and other major currencies.

Oil Prices

It is hard to avoid the importance of the world price of oil for the Russian economy. Russia exports such large quantities of crude oil and various oil products that every dollar's increase in the price of a barrel of petroleum translates into roughly $1.5–$2.0 billion of additional yearly export revenues. The world oil price rose from barely $10 a barrel in February 1999 to more than $27 a barrel a year later, continuing eventu-

ally on up to more than $30 before it began a gradual decline. This is roughly the same trend as noted in Russia's industrial output.

In fact, the relationship between oil prices and industrial output is so close that it is tempting to ascribe virtually all of Russia's post-August 1998 economic performance to oil. That is, all the other factors that are assumed to influence economic performance—exchange rate dynamics, monopolies' pricing policy, taxes, investment rates, competition policy, capital flight, banking reform, monetary policy, and progress on corporate governance and "rule of law"—would be irrelevant. In fact, it would be a mistake to ignore those factors. Without the oil price rise, Russia would not have had its boom; but without sensible economic policy, things could have been a disaster. Or, to take it the other way around, sound policy allowed the Russian economy to take advantage of the oil price increases, but that sound policy could not have been a substitute for the oil price effect.

Devaluation

The second obvious economic factor that has been important for the post-1998 economy is the real devaluation of the ruble that occurred in the wake of the crisis. This was the consequence of a nominal depreciation that exceeded ensuing inflation. By the end of 1998 the real value of the ruble relative to the U.S. dollar was about 36 percent of its July value.

This dramatic devaluation benefited many Russian producers. For exporters of commodities whose prices were denominated in dollars on world markets, the effect was immediate. Their costs were primarily ruble based, while each dollar they earned was now worth many more rubles than before. Hence, even without making any changes in the way they did business, the exporters saw dramatic improvement in their profit and loss statements.

The devaluation was also important for Russian producers that sold their products on the domestic market in competition with imported goods. In response to this dramatic rise in prices of imported goods, Russians turned to cheaper domestic products. That in turn led to a boost in output and profits in the domestic consumer goods sector (mainly the food and light industries), but it was a one-time result. Output there is now flat, or down. In 2000, real profits in light industry were down 20 percent from 1999 levels; in the first half of 2001, they dropped another 34 percent.

WHAT REMAINS?

Both the oil price and the devaluation effects are temporary. Although they provide a windfall while they last, they cannot contribute

to making the economic recovery sustainable except to the extent that they change the underlying structure of the economy. What we need to know is whether the windfalls from high oil prices and the cheap ruble were used to make the economy more competitive than in 1997 once the high oil prices and cheap ruble themselves are gone.

One obvious place to look is capital investment. As Figure 2 showed, investment picked up in late 1999 and continued to grow vigorously through 2000. However, we must remember that the economy began from a low base. Investment in the Russian economy fell in the 1990s even more than output. By 1997 the economy was spending only one-quarter as much on new plant and equipment as it had in 1990. This means that even the growth rates of 20 percent per year that were reached in the second half of 2000 were quite modest in absolute terms. And the current rate of growth—6–7 percent per annum—is all the more inadequate.

Moreover, the rates of fixed capital investment continue to drop. Recent figures show that more than a third of Russia's regions invested less, not more, in the first half of 2001 than they did in the first half of 2000. The regions that showed declines in capital investment included such important economic centers as the cities of Moscow and St. Petersburg, and the regions of Krasnodar, Stavropol, Nizhny Novgorod, Saratov, and Sverdlovsk.

Similarly disturbing trends emerge when investment is disaggregated by sector. The food industry, for instance, invested 15 percent less in the first half of this year than it did in the first half of 2000. Investment by machine-building and metalworking enterprises was down by 18 percent. For the time being, oil and gas continue to carry the rest. The oil and gas sector invested 19 percent more than last year. (And remember that oil and gas invests about 10 times as much as either heavy manufacturing or the food industry.) Thus, not even by the crudest of measures, gross capital spending, has the opportunity afforded by the devaluation and oil price rises been used to appreciably upgrade production capacity in most of the economy.

Perhaps the single most telling fact about what has and what has not been accomplished in the past three years is that despite extraordinarily favorable recent conditions, a staggeringly high proportion of Russia's industries remain unprofitable. The 1998 devaluation did reduce the number of loss-making enterprises somewhat, from more than 50 percent to around 40 percent, but the improvement stopped at that point. Thus, for three years now, some 40 percent of Russian industrial companies are still not profitable. Russia thus remains burdened by tens of thousands of nonviable enterprises that cannot compete and yet live on year after year, no matter what the macroeconomic and policy environment.

Today the spectacular growth rates of Russia's economy in 1999 and 2000 have slowed considerably. The slowdown in the world economy and the large decline in world oil prices now threaten growth even more. As growth contracts in Russia, it is inevitable that government budgets will become tighter. It is likely that local and regional budgets will be most affected. This means that some ambitious plans for small business promotion will be threatened by lack of funding.

The ups and downs of the general economic climate must, however, not be taken as reason to abandon all efforts to promote small business. What is most important is that governments at all levels draw up plans on the basis of realistic assessments of the economic future and that they commit themselves to implement those plans over the longer term.

Steps Being Undertaken by the Snezhinsk City Administration to Support Small Innovative Companies

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One way or another, the progress of all civilizations has always been connected with new technologies and goods based on new knowledge. It is commonly said that innovations lie at the foundation of development. In the twentieth century, the role of innovations especially increased in the evolution of society. Today it is universally clear that only by relying on knowledge can any state succeed in solving its internal problems and satisfying the needs of society as well as winning the competitive struggle for world markets for products, technologies, and services.

The paradox of the development of the Soviet scientific-technical sphere was that an immense number of research discoveries were never implemented in practice. As a result, a country that possessed a powerful scientific-technical complex produced civilian products that were uncompetitive on the worldwide market. Individual scientists and scientific collectives had no economic incentives to turn their research results into competitive products in demand on the market. The well-being of scientific organizations has almost no relation to the results of their work.

In our view the innovation policy of the state must play the leading role in the formation of the country's economy. The effectiveness of this policy determines the ability of domestic manufacturers to incorporate new ideas, work actively, and above all compete successfully in the world market. Therefore, the current status of innovation activity and the problem of promoting innovation processes in our country are more urgent today than ever before.

[*] Translated from the Russian by Kelly Robbins.

Present worldwide practice indicates that many problems related to research and innovation activity (lack of investments due to the "scientific risk," selection mechanism for promising areas of scientific research, targeted funding system, sufficient conditions for free creative self-realization, etc.) were successfully resolved over the course of decades in other countries by means of sharing the costs for scientific and innovation-oriented research between the state and private sector. The greater the attention paid by the state to creating scientific-technical potential, the more major companies spent on research and development efforts. Therefore, state funding takes on even greater significance in our country, as there are practically no investments from the commercial sector for this purpose, thus depriving the country of an important funding source.

Regarding Chelyabinsk Oblast in general, it has been established that investments in small businesses are recouped two to three times faster than investments in large industrial enterprises. According to statistical data, labor productivity in small businesses is 50 percent higher in monetary terms than the average for the oblast. The development of small business can solve the employment problem, as this sector is more dynamic in job creation. Furthermore, the cost of job creation in the small business sphere is several times less than in large enterprises. Meanwhile, small business also solves the problem of filling the market with consumer goods and services, improving the quality of life for citizens, and promoting the political stabilization of society.

Despite the fact that small business is one of the most important economic sectors and its development affects the development of our region and Russia in general, the oblast government and the Chelyabinsk Oblast Legislative Assembly do not pay enough attention to issues connected with small business development and support. There are numerous problems affecting this sector: administrative-bureaucratic obstacles, the poorly developed nature of oblast-level legislation on small business, the tax burden, the cumbersome accounting system, the lack of the necessary social protection for owners and employees of small enterprises, the absence of financing in the oblast budget for small business support. All of this has a negative impact on the dynamics small business development. Thus, the lack of regional investments in small business development in our oblast represents a serious financial and economic oversight on the part of the oblast administration.

As for the Snezhinsk city government, the city administration and Snezhinsk City Council have chosen their own way of developing the innovation activities of small business. On the whole, small business support is provided in three main areas: regulatory, financial, and organizational.

REGULATORY SUPPORT

Regulatory support includes the adoption of laws and regulations that promote the efficient functioning of the system.

- In 1999 the Targeted Comprehensive Program for the Support and Development of Small Business in Snezhinsk for 2000–2001 was prepared.
- The Regulation on Investment Activity in the Closed Administrative-Territorial Zone of the City of Snezhinsk was adopted in Snezhinsk City Council Resolution 30, dated March 13, 2000.
- Taking into consideration the recommendations of the Snezhinsk Entrepreneurs Association, the Snezhinsk City Council issued Resolution 93, dated June 28, 2001, which included a series of measures focused on small business development in Snezhinsk.

Following are some extracts from the Regulation on Investment Activity in the Closed Administrative-Territorial Zone of the City of Snezhinsk: "This Regulation was developed to create incentives for organizations and individual entrepreneurs to make long-term investments. . . . The main objectives of promoting and creating incentives for investment activity include creating new production facilities in the city and preserving existing ones, creating additional jobs, increasing the employment rate among citizens, and augmenting the city budget with increased tax revenues. Our policy of attracting and allocating investment funds is based on the principle of providing investors with an economic interest in creating new production assets and establishing new production facilities in the closed city of Snezhinsk through various forms of support provided by local government agencies."

To varying degrees, these documents highlight the top priorities for small business development in the city. These priorities include expanding the production of competitive science-intensive products; accelerating the transfer of technologies to the production sphere; developing a technology transfer support infrastructure; creating employment opportunities for highly qualified engineers, technicians, researchers, and specialists; and promoting small-scale industrial manufacturing and the production of consumer goods that can replace imports.

In addition, various forms of support for small- and medium-sized business were defined and adopted. This support includes investment tax credits, additional local tax exemptions, loans (credits) and loan guarantees on preferential terms, other nonfinancial privileges (municipal orders on preferential terms, assistance in business infrastructure creation, leasing or sale of municipal lots and nonresidential buildings that have been placed in municipal ownership according to established procedure), and cofounding of economic organizations, with part of the shares of the new companies becoming municipal property.

FINANCIAL SUPPORT

Taking into consideration the shortage of budget funds, the main emphasis in small business support has been placed on developing advanced methods of raising nonbudget resources.

- The Municipal Fund for the Support of Small Business was created by Resolution 774 of the Snezhinsk City Mayor, dated October 3, 1995.
- The Municipal Nonbudget Fund for the Socioeconomic Development of Snezhinsk was established by Resolution 100 of the Snezhinsk City Council, dated June 23, 1997, and Resolution 470 of the Snezhinsk City Mayor, dated June 24, 1997.

These funds are noncommercial organizations, and profit-making activity is not their main goal. The main objectives of the funds are as follows: (1) facilitating the implementation of state policy in Snezhinsk regarding the formation of market relations on the basis of small business support, and (2) developing competition by attracting and efficiently using financial resources to implement targeted programs for the support and development of small business.

The primary areas of the funds' activities are the following:

- participation in the development, expert review, competitive selection, and implementation of municipal programs focused on small business support and related projects in the small business field, including demonopolization of the economy, development of competition, satisfaction of the goods market, and creation of new jobs
- participation in the formation of a market infrastructure providing equal conditions and opportunities for small business operations
- support for entrepreneurial innovation activity, stimulation of the development and manufacturing of fundamentally new types of products, assistance in putting new technologies and inventions into practice
- assistance in attracting domestic and foreign investments to pursue top-priority objectives in creating a competitive environment and developing small business

To achieve their primary objectives, the funds are involved in the following activities:

- accumulating monetary resources (nonbudget)
- providing financial assistance in conformity with Russian law on a free and paid basis to develop competition and increase the goods available on the market
- serving as a guarantor for the obligations of small businesses

- sharing in the foundation and operation of economic entities
- financing activities focused on providing training, retraining, and professional development for employees of small enterprises, supporting new economic structures, and protecting the rights of consumers
- funding scientific research, scientific and practical conferences, symposiums, meetings, and exhibitions, including international ones
- organizing activities focused on attracting and efficiently using funds provided by domestic and foreign investors
- collecting and processing legal, patent, licensing, and other information of interest to small business entities; studying domestic market conditions; providing consulting and organizational-methodological assistance in the development of programs and projects in the small business sphere
- forming creative collectives, expert councils, and commissions, including those involving foreign specialists
- sending specialists for training, retraining, and professional development, including to programs abroad

Because the financial resources available to the two Snezhinsk municipal funds differ substantially, there has been a sort of "unspoken" division of responsibilities between them. The Municipal Nonbudget Fund for Socioeconomic Development focuses its resources on supporting and developing medium-sized businesses, while the Municipal Fund for the Support of Small Business provides assistance to small businesses, as its name would indicate. For the sake of clarity, Table 1 presents quantitative data and the volumes of financial resources provided by the Snezhinsk municipal funds in 2000–2001 for supporting and developing small- and medium-sized businesses, including those involved in innovation activity:

In addition, the Snezhinsk City Administration participates in the foundation of economic entities, with a portion of the shares of the new enterprises being secured under municipal ownership. The following organizations may be cited as examples:

Bars-70

The city administration is one of the founders of this limited liability company. The main activities of the organization include developing, designing, manufacturing, and assembling filters, ventilation systems, and air regeneration systems. The company has developed its own original ionizing, power-supply, and precipitation units that differ from foreign models. A patent search has been conducted regarding these issues. A number of technical features require more comprehensive patent research in order to secure patents.

TABLE 1 Support for Small- and Medium-Sized Businesses in Snezhinsk

Funding Sources	Number of Projects	Total Amount of Financing
Municipal Nonbudget Fund for the Socioeconomic Development of Snezhinsk	20	71,802,000 rubles
Municipal Fund for the Support of Small Business	70	17,737,000 rubles

In addition, Bars-70 has obtained a loan in the amount of 2,448,000 rubles from the Municipal Nonbudget Fund for the Socioeconomic Development of Snezhinsk to develop promising areas of activity.

Spectrum-Conversion Research and Production Enterprise

The focus of this limited liability company involves organizing and carrying out work in industrially promising fields of geological and geotechnological research in the development of the mining potential of the Urals and other Russian regions. The company also pursues research and production activity concerning the development and application of new technologies in production; the implementation of scientific-technical achievements in the mining and processing of precious and rare stones and metals; and the development and application of low-waste, environmentally clean, and resource-saving technologies.

Spectrum-Conversion is currently carrying out the following innovation projects:

- organization of serial production of high-temperature electric heating devices
- creation of a production facility for improving precious stones
- organization of production of traffic safety equipment and devices using super-bright diodes

At the time of its foundation, the enterprise had authorized capital stock of 6,506,000 rubles, with 99.88 percent belonging to the City Administration Committee for Property Management. In addition, Spectrum-Conversion received 10 million rubles in loans from the Municipal Fund for the Support of Small Business.

ORGANIZATIONAL SUPPORT

In 2000, with the active support of the Foundation for Russian-American Economic Cooperation and the U.S. Department of Energy,

the Snezhinsk City Administration and the Snezhinsk City Council established the Snezhinsk International Development Center (IDC) Foundation. The IDC is a nonprofit organization with the following main areas of activity:

- promoting a favorable investment environment in the closed city of Snezhinsk
- aiding in the search for investors for industrial diversification projects and assisting with market analyses
- organizing training for employees laid off from nuclear enterprises
- providing information to enterprises about access to financial resources to fund projects and activities
- helping to identify and create new favorable economic opportunities in the closed city of Snezhinsk
- providing consulting and informational support for the investment activities of state and municipal enterprises and private businesses and in the preparation and development of promising technologies and production facilities
- providing assistance in developing and conducting expert reviews of investment projects and programs aimed at supporting the economy in the closed zones
- helping local government agencies to develop investment stimulation programs, strategic plans, and development concepts
- rendering information and consulting services to businesses and local government agencies in the field of investment opportunities

On October 24, 2000, a conference for entrepreneurs entitled "Small Business in Snezhinsk: Problems and Prospects" was held in Snezhinsk. Having heard and discussed the reports and presentations made by local government leaders, representatives of municipal nonbudget funds, other city organizations and institutions, entrepreneurs, and small business managers, conference participants stated that the city has created a functioning system for providing financial support to small business. At the same time the current climate is not sufficiently favorable for the development of business, including innovation-oriented business. Many entrepreneurs gave pessimistic forecasts regarding their further business prospects. The lack of funds and production facilities is urgently felt. Existing "administrative barriers" also hinder business development in the city, and owing to a number of objective reasons, these barriers are much stronger in the closed zones than in other cities and regions of the oblast. Interest rates are still rather high for small business, and having collateral or a guarantor is an obligatory condition for obtaining loans, which limits credit opportunities for businesses at the start-up or expansion stage.

Entrepreneurs at the conference made the following suggestions:

- Snezhinsk local government agencies should provide for increased credit resources at the municipal funds in order to reduce interest rates for small business. A venture capital loan mechanism should also be developed.
- The possibility of using city funds to construct office and production space for start-up companies should be considered.

Unfortunately Russia is ill prepared to initiate efficient development of the venture capital business, and Snezhinsk is no exception. Those with financial resources are scarcely starting to realize that investing for a period of several years is the norm, and moreover it can be profitable. The country lacks the necessary number of managers for new venture companies, though this problem is slowly being resolved. There are legal problems, mainly in the sphere of taxation. A system for the interaction of inventors and investors has not yet been worked out, and there are many issues of an infrastructural and psychological nature. For instance, it is no secret that inventors have little concept of the structure of costs required for product development and marketing. Many years of statistical data indicate that development costs rarely exceed 25–30 percent of total costs even in developed countries where skilled labor commands very high wages. About another third of the total costs goes for setting up full-scale production, and the same amount for marketing operations regarding product promotion and distribution. In Russia, development costs are usually lower, but promotion costs and costs of organizing full-scale production are higher because production lines are worn out and almost 100 percent of the necessary equipment must be purchased.

Inventors and investors are not yet ready to compromise. Inventors are hardly willing to prepare serious business plans, including assessments of the market and product prospects based not on speculative conclusions but on market facts. Investors are reluctant to consider projects when the business plan is not yet complete.

Current tax legislation also presents a big problem in the development of the venture capital business. If as a result of budget shortfalls we cannot provide effective support for technology-oriented business now, as it is done in the developed countries, which have two-stage grant systems, then at least we need to introduce tax benefits regarding stock investments in projects. At the very least, this should be done for the companies that are commercializing the newest Russian technologies. A high-tech project is not a bakery that can pay back investments a week after its equipment has been installed. Here we are talking about three or four years or more. Therefore, certain special conditions should be created for such projects:

- Venture investors must take on many more functions connected primarily with establishing and developing business processes in the company in which they invest, so they should be compensated for this in the form of more favorable partnership conditions. Many projects do not pay proper attention to the issue of creating incentives for investors. Mainly, they emphasize the technical advantages of the product.
- When resources are in short supply, it becomes more important to join several similar projects separately developed by various participants into one larger project that could include all their best features. Solving the problem of finding potential participants and forming a single overall project would substantially increase the chances of the project's success.
- Loan financing will play a significant role for projects that have reached the stage of commercial implementation and are looking to expand. Accordingly, many projects should be adapted with an eye to the specific requirements of lending organizations.

Thus, we should place special reliance on efficient, nonstandard solutions, which have often led to success in many undertakings. One such nonstandard solution could be the creation of innovation centers or business incubators, that is, appropriate facilities used by their owner to provide entrepreneurs with the following services on mutually beneficial terms:

- long-term rental of office and production space
- a range of services to facilitate innovation and economic activity

The goal of such a business incubator is to promote the preservation and development of scientific-technical potential by supporting the innovation process carried out by entrepreneurs at its facilities.

It may also be said that the majority of innovation projects are sufficiently well elaborated from the technical standpoint. However, the following general defects are noted:

- no clear market positioning of products and company trademarks and no qualitative comparative analysis of competitors
- unresolved intellectual property and patent protection issues, in many cases

At the same time, one of the most substantial factors hindering the development of innovation-oriented business lies in the undeveloped nature of the information infrastructure focused on serving the interests of both investors and entrepreneurs.

In conclusion, I would like to add that the investment policy of Snezhinsk local government is aimed at supporting and assisting small

business, not creating it. The Municipal Fund for the Support of Small Business has conducted a sociological study entitled "Focus on the Small Business." Based on the results of this study, specialists reached the following conclusion: "Entrepreneurs are rather well informed about available municipal forms of small business support, but in fact almost none of them ever use this information in practice."

The Role of Foreign Partners as Investors or Customers in the Development of Small Innovative Firms

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Throughout the world, attracting external companies, including those from abroad, is regarded as a key resource for regional economic development. At present, conditions have developed in Obninsk such that they could serve as a sufficient stimulus to attract foreign strategic investors and partners. The creation of those conditions was facilitated by the following factors:

- long-standing scientific contacts between Obninsk research institutes and international organizations and foreign scientific centers in various fields
- focused efforts to search for partners, as well as support of projects having high priority in terms of their importance for economic development
- long and fruitful cooperation with Oak Ridge, Tennessee, as our sister city
- positive experience cooperating with the Eurasia Foundation on diversified efforts to support market-oriented economic reforms in Russia
- successful teamwork on Tacis Program projects
- participation in the project entitled "Technological Cooperation Between Kaluga Oblast and the Netherlands"

Of course this list of factors is not complete, with the most important factor being the Program for the Development of Obninsk as a

[*] Translated from the Russian by Kelly Robbins.

Science City, which was adopted by the legislature and is now being implemented.

Under the program, a set of measures is being carried out to attract foreign companies, including the following specific activities:

- creating a portfolio of investment proposals
- preparing specialized informational materials about Obninsk intended for foreign companies interested in establishing or expanding their business in Russia
- marketing the city of Obninsk to help promote it on the Russian and international markets
- preparing documentation on industrial sites available in Obninsk and on other resources required for foreign companies to establish their businesses

Unfortunately the city's authority to grant tax breaks is quite limited. The only considerable tax benefit available under the present tax law is that regarding the profits tax. Preferential rates on all of the other taxes paid to the city treasury are so small as to make any talk about their attractiveness meaningless.

If the project happens to be of a clearly regional character, however, the situation could become more attractive as a result of additional concessions on taxes payable to the oblast.

Thus, the maximum special exemption for the property tax (50 percent of which goes to Kaluga Oblast and the other 50 percent to the city) can be 100 percent. For the land tax (50 percent remains in Obninsk and 30 percent goes to Kaluga), it will be 80 percent. With the standard rate of 24 percent for the profits tax, the tax benefit for it could reach 68.7 percent (2 percent goes to Obninsk and 14.5 percent to Kaluga).

Other measures within the city's powers include reducing the rate for land rental or making buildings with the required infrastructure available on advantageous terms.

At present, 13 joint ventures and 11 businesses with 100 percent foreign capital are operating in the city. As a rule, these are small businesses. Their activities are rather diversified, including the production and bottling of mineral water (the POLLO firm), ketchup production (MOSSPOL), footwear manufacturing (the Shafran limited liability company), medical technologies and pharmaceuticals (Vienna-Obninsk Biomedical Laboratory, the German Intensive Therapy Clinic, Mir-Pharm), and others. In addition there are a number of Russian firms operating in Obninsk that fill orders for foreign customers, including such high-tech firms as Eridan, Ekon, Converscenter, and Theseus.

Both positive and negative experience has been accumulated in the implementation of international projects in the city. I shall cite two ex-

amples of successfully operating high-tech companies whose experience should be studied and replicated.

Cyco Software is the world's leader in the development of AutoCAD and office automation systems. The company, which began operations in 1987, has now developed the most advanced of modern software products. Cyco is a multinational corporation with its headquarters in the Netherlands and branches all over the world. Located in Atlanta, Georgia, Cyco International is responsible for sales, marketing, and technical support in the Americas, Asia, and Australia. The Cyco-Europe branch handles sales, marketing, and technical support in Europe, the Middle East, and Africa. Finally, Cyco has created a center for technology development in Russia in Obninsk called Cyco-Russia.

Cyco-Russia's history began in the early 1990s. Cyco Software management first visited Obninsk in 1991. They had received information about the city from the Netherlands Ministry of Economic Affairs and from some of their friends who had high-tech business contacts with a subsidiary of the Russian State Research Center Institute of Physics and Power Engineering (IPPE). Cyco Software managers were looking for new ways of improving the company's performance by involving professional programmers from Russia.

In the unstable economic conditions of the early 1990s, doing business in Russia seemed very risky, but such factors as the availability of a highly skilled workforce and relatively low costs compared with Western countries tipped the balance. Cyco gave trial projects to a few Russian programmers, and the results were very good. So Cyco realized that it had found the right people in the right place. That was how their cooperation began. The Cyco-Russia company was founded in 1994.

The partnership has proven mutually beneficial. The Dutch company recruited highly qualified Obninsk programmers at relatively low salaries and in this way solved its human resources problem. In turn, the city acquired a new stable and disciplined taxpayer in the Cyco-Russia company, and Russian specialists got jobs in their fields appropriate for their high qualifications.

Today Cyco-Russia is a full-fledged high-tech company with several dozen employees. Thanks to the high quality of their work, Cyco-Russia's specialists are increasingly relied upon by the Dutch partners, with the company taking on an increasing number of projects as it develops and grows.

The Obninsk City Administration appreciates the fact that the Dutch company invested in the city's economy during such a difficult period, so it is now giving Cyco-Russia its full support and assistance.

It should be mentioned that the creation of companies like Cyco-Russia is entirely in keeping with the Program for the Development of Obninsk as a Science City. The key idea of the program is to minimize the

dependence of the city's economy on the federal budget. Obninsk is striving to commercialize its scientific and economic potential by stimulating modern production and services. Meanwhile, preference is given to developing small- and medium-sized high-tech businesses.

Cyco-Russia can serve as an example of real international cooperation in the high-tech field and a graphic demonstration of the potential for successful investments by foreign companies in Obninsk.

Another example of successful cooperation is the firm SSI/Russia, which was registered in Obninsk in July 1993. The company's full name is "Subsidiary of the California Corporation SSI/Russia." The company was organized on the initiative of former IPPE employees Yury Belogortsev and Alfred Mirzagitov. In early 1992 Yury Belogortsev won a contest organized in Moscow by an American foundation supporting beginning Russian entrepreneurs. Contestants who passed all three rounds of the contest were given the opportunity to go to the United States for a one-month internship in an American company. That was how Yury Belogortsev got to know George Rothbart, president of the California company Software Science, Inc. In the process of learning more about the work of the American company, the first contract was signed, and it was carried out so successfully that the Software Science management decided to open a new branch using a team of programmers from Obninsk. As a result, SSI/Russia, a business with 100 percent foreign capital, was incorporated.

The firm is engaged in the development of different software products used in the following areas:

- database management systems
- office applications
- software for end users (shrink-wrap software)
- telecommunication systems based on Transition Control Protocol/Internet Protocol (TCP/IP), including wireless technologies
- online data acquisition and processing systems
- web sites, including e-commerce sites

Since the firm was founded, it has been oriented entirely to the American market. All products and systems have been developed for American companies and individuals, and the parent firm in California is responsible for routine contacts with customers and technical support for its software products. The use of the entire spectrum of modern telecommunications technologies, such as the Internet, IP-telephony, remote paging, and cellular telecommunications helps to eliminate any inconveniences related to the two companies being in different time zones and located so far apart. In fact, the company takes advantage of the 11-hour time difference in solving urgent problems for clients—for example, work on those

problems can go on 24 hours a day. This is particularly important for online projects, such as one of the most popular American sites for selling cars, *www.carsmart.com.* The project is the pride of the company. It was developed for the AIN Corporation, starting from scratch in 1996 and continuing with site maintenance over the past five years. In January 2000 the project was bought by AutoByTel for $20 million.

Other examples of successful projects include the following:

- a real-time system for tracking financial transactions of ticket vending machines and gauging passenger flows in San Francisco subway stations (the customer was Bay Area Rapid Transfer)
- a worldwide technical support notification system for the Amdahl Corporation
- unique radiomodems with automatic packet routing (Dynamic Forward Routing) for the firm CommUniqueWireless

There have been a number of problems (organizational, technical, personnel related) encountered during the formation and development phase at this company.

ORGANIZATIONAL PROBLEMS

It was hard to overcome the differences in business models of the American and Russian enterprises, with each having different accounting systems and different business cultures. Added to that were difficulties that are very hard to explain to the American partners, such as frequent changes in tax legislation, bureaucratic hindrances in the economy and customs procedures, and so on. It would take quite a while to list all the problems and ways of solving them, especially considering the specifics of the type of production involved (e.g., the nonmaterial nature of the end product, which led to certain conflicts with tax inspectors who could not understand how work could be sent over the Internet without making out customs declarations and so forth). In addition mention should be made of the rather heavy demands made of workers at the subsidiary with regard to their knowledge of the English language, as all correspondence, negotiations, and software systems development is done in English.

TECHNICAL PROBLEMS

The first technical problem was poor communications channels between Russian and American partners, including mail, electronic communications, and transportation. All of those problems were gradually resolved as the market economy developed in Russia. As a result, we now have a very good system for accessing the Internet (Obninsk has a fiber

optic network for Internet access with 4.5 Megabit bandwidth), a reasonably good mail service (DHL, FedEx), and conventional ways of solving transportation problems (provided that you have a visa, you can get to the customer within 48–72 hours).

PERSONNEL-RELATED PROBLEMS

In 1993 it was not at all difficult to find a skilled programmer for a specific project. Today the search could take a good deal of time owing to easier access to the European and North American job markets, as well as the influence of Moscow, the nearby megalopolis. Nevertheless, Obninsk still has considerable intellectual resources for handling most software development problems.

In its early days the subsidiary employed four programmers, but now the number of employees ranges from six to eight depending on the volume of work. The subsidiary operates steadily, and personnel turnover is low. In the near future, SSI/Russia will be considering options for expanding cooperation with information technology companies in Europe in order to diversify its market and smooth out workload fluctuations caused by the American market.

The availability of highly qualified personnel with the necessary skills and knowledge, the absence of language barriers in communications not only among management but also with rank-and-file workers, and accessible opportunities for familiarization with current experience all contributed to the success of the companies mentioned above.

And yet we also have an example of how a well-prepared major investment project was ruined by the unprofessional actions of regional politicians.

During 1995–1998, work was done to promote a major Russian-Dutch agrarian project involving the creation of Protva-Agro, a sales and service company that was registered in Obninsk in 1998 (its initial capital was about 25 million new rubles).

The project was supposed to introduce modern agricultural technologies for growing crops in the Obninsk area as well as create a specialized sales network. Implementation of the project would have helped to create new jobs not only in the cultivation and sale of agricultural produce but also in the necessary processing infrastructure.

The financing plan amounted to more than $10 million in foreign investments (about $4 million from the World Bank for a period of 10 years and about $6 million in the form of a loan from a Dutch bank guaranteed by the Netherlands government). It had been fully worked out and approved by all interested organizations. Unfortunately, in May 1998 the Kaluga Oblast Legislative Assembly refused to serve as a guarantor of the project, thus causing it to be completely shut down and, in the

process, undermining the image of Kaluga Oblast as a region capable of attracting foreign investments.

Another international project should also be mentioned. In February 1999 the Regional Agency for the Promotion of Investments and Technologies (RAPIT) was founded in Obninsk as a component of the international project entitled "Technological Cooperation between Kaluga Oblast and the Netherlands." This project represents a joint initiative of the Netherlands government, the Kaluga Oblast government, and the Obninsk City Administration. The Netherlands is represented by a number of Dutch companies that had won the right to implement the project in a 1998 tender announced by the SENTER Agency of the Netherlands Ministry of Economic Affairs.

The main goals of the project were to support the development of small- and medium-sized high-tech enterprises in Kaluga Oblast and to establish mutually advantageous business contacts between enterprises in the Netherlands and Kaluga Oblast. These goals are in complete accord with those of the program to develop Obninsk as a science city.

POSITIVE RESULTS

- For the first time, we have succeeded in establishing long-term business relations with the investment institutions of the Netherlands. This partnership offers good prospects for the further cooperation with the International Science Cities Foundation (ISCF), which is engaged in providing venture financing for Russian high-tech companies and fostering the further development of joint enterprises that have received financing. Other opportunities involve continuing business contacts within the "business-to-business" project and attracting the Dutch-American Investment Fund SEAF to Obninsk.
- This activity is supported by the authorities on both sides—the Obninsk City Administration and the Netherlands government via the SENTER Agency. This creates the most favorable conditions and guarantees, which is undoubtedly important in securing high-risk start-up financing for newly created enterprises.
- Despite the difficulties in the initial phase, the past three months since the arrival of a new team in RAPIT have seen the completion of a plan for the investment of Dutch capital in Russian-Dutch joint ventures, taking into account the particularities of Russian and Dutch legislation. Since June 2001, two joint venture agreements have been concluded. Entrepreneurs from Obninsk, Balabanovo, and Maloyaroslavets have submitted preliminary applications and business plans for five new projects, including the following: Tandem—painting chambers for vehicles; Winter Harvest—mobile greenhouses with new technology for vegetable growing; Cartridge Plus—refilling of all types of cartridges, and so on.

- RAPIT would not like to restrict its activity only to collaboration with the Netherlands, so it is expanding the bounds of its contacts. For example, preparatory work is already under way to identify investment opportunities in Oak Ridge, Tennessee.

NEGATIVE EXPERIENCE

- Because of the lengthy procedures for project financing, the ISCF was not able to finance all the projects as planned in the project terms of reference.
- The scope of RAPIT's activities has been limited primarily to Obninsk.
- The effort to create a business incubator in Obninsk was launched only in the final stage of the project.
- Despite the very careful selection of RAPIT staff (four persons), the team disintegrated by spring 2001. Having acquired new knowledge and skills and having completed training in the Czech Republic and the Netherlands, they essentially split into two groups. This was largely due to the unconstructive and generally willful actions of the former director of RAPIT, who was not able to establish a normal working relationship with the representative of the Dutch consortium. This situation could not fail to affect the quality of the staff's work and their relations with the Dutch partners.

Even so, there is a positive aspect that speaks to the level of training of the staff. One of the staff members who left RAPIT, Andrei Perekhrest, is currently the director of Cyco-Russia, while another, Oleg Shershakov, is a senior manager with the financial company StoraEnso. However, even the negative results have positive significance, as they represent important lessons from which the correct conclusions must be drawn. The new RAPIT staff has made a thorough analysis of the agency's activities during the first two years of its operations. Serious corrections have been made, taking into account the negative experience and the mistakes that were made.

PROSPECTS

- RAPIT participates in the implementation of the Program for the Development of Obninsk as a Science City. The directors of the program have approved projects involving the joint participation of RAPIT and the Franco-Russian Institute of Business Administration (FRIDAS) in developing the international marketing plan for Obninsk and creating the website "Investors Guide."
- An application is being prepared for participation in a joint project entitled "Development and Creation of a Package of Presentation and

Informational Materials Aimed at Attracting Foreign Investments to Obninsk on the Basis of Analyzing and Adapting the Experience of Oak Ridge in Promoting Itself in the Innovation Technology Market."

- A public relations project on the development of the Obninsk investment infrastructure using the technopark model is also being prepared.
- There are opportunities for participation in the selection and placement of small innovation-oriented enterprises in the business incubator.
- A joint project is being prepared for collaboration between the Chambers of Commerce of Obninsk and Oak Ridge.
- It would be wrong to say that joint enterprises and firms with 100 percent foreign capital contribute substantially to the city's economy. We are still in a preliminary phase. Of course, the legislative basis for stimulating foreign investments must first of all be strengthened at the federal level.

At the same time, the city is doing a great deal in this area within the scope of its authority, as you have heard. We hope the number of positive examples of international cooperation will increase with each passing year.

The Role of Foreign Partners as Investors and Customers in the Development of Small Innovative Companies

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This paper discusses specific examples of collaboration between foreign partners and small innovative companies in Sarov. New innovative firms began to be created as a result of defense cutbacks and subsequent layoffs of personnel employed by the main organizations in the city of Sarov, that is, the Russian Federal Nuclear Center–Scientific-Research Institute of Experimental Physics (VNIIEF) and the Avangard Electromechanical Plant. Addressing these problems requires a creative approach and funding from various sources.

At present there are several companies in Sarov that work with foreign partners as investors or customers.

The closed joint-stock company Titan was established in 1997. It is a high-tech enterprise that manufactures parts from titanium alloys with a variety of preset properties for use in the aircraft, automotive, chemical, and medical industries. The technical concept used by the company differs from conventional techniques used to manufacture titanium alloy parts. Based on hot pressing and vacuum thermal treatment, it considerably reduces costly raw material expenses and provides finished products with the required technical parameters.

The highly qualified specialists employed by the company have unique technical experience in thermal and mechanical treatment of titanium al-

[*] Translated from the Russian by Kelly Robbins.

loys. This makes it economically feasible to manufacture components for orthopedic prosthetics, fasteners, and other items from titanium alloys.

The company conducts business in the European and Russian markets. To date, its most important customers are Pertsch & Partner (Germany), Scanburg AB (Sweden), and Teb AB (Sweden). Titan currently employs about 120 people.

The open joint-stock company Rehabilitation Center was founded in 1997 to develop and introduce into practice medical technologies, mainly diagnostic and prophylactic in nature. The company has several projects under way, two of which are funded by U.S. partners under the Nuclear Cities Initiative (NCI). These projects are aimed at creating a Laparoscopy Center (opened in July 2001) and a Telemedicine Center in Sarov. The partner (Medical College of Georgia) provided free delivery of the specialized laparascopic equipment and trained the new center's 12-person staff. In this particular case the foreign partner is an investor in the Russian enterprise.

The Open Computer Center (OCC) is one of the first projects carried out under the NCI Program, opening on October 1, 1999. The firm has been accorded the status of a unitary state enterprise. The OCC project is related to defense conversion and was not started from scratch, but rather on the basis of the existing history of scientific collaboration between specialists from VNIIEF and colleagues from the U.S. national laboratories. A foundation for the project was also provided by research work done by VNIIEF scientists on projects for the International Science and Technology Center (ISTC) and work on developing software for microprocessors for Intel, among others. The main activities of OCC are the following:

- research on the development and improvement of physical and mathematical models to describe various physical processes
- research on the development and improvement of numerical methods
- creation of applied programs and software packages for the mathematical modeling of various processes

Initially, collaboration with the foreign partner was pursued along two main lines:

1. funding for the establishment and further development of OCC (U.S. Department of Energy [DOE], Los Alamos National Laboratory)
2. development of software products in response to customer orders, as OCC is mainly oriented towards foreign markets, primarily the United States

At present OCC has 76 fully equipped workstations, but the company plans to expand to a staff of 200.

The closed joint-stock company VNIIEF-STL was registered in Sarov in March 1999 and currently employs 100 people. It was established based on a contract between Intel and VNIIEF that has been in effect since 1993. For the most part the company develops and produces software ordered by Intel. Several of its products are of real commercial value and are actively marketed by Intel. Thus, in this case the foreign partner acts as a customer.

The Diamond Processing Factory (ABP) was established in December 1993. The facility has been producing finished products since 1996, becoming profitable in late 1999 (in combination with its jewelry manufacturing unit). ABP's main foreign customer is the Belgian firm Diamond Manufacturing, which provides precursor materials.

The company has gained experience in using foreign automated equipment for diamond cutting. Close collaboration with the Belgian partner not only has allowed them to gain this experience, but also has provided them with the main equipment for the automated processing section. Placing its confidence in long-term cooperation, the Belgian firm gave ABP the equipment so that the enterprise could learn more about its capabilities and refine its cutting technology. The equipment is currently in safekeeping with ABP until the decision is made to either purchase or return it. At present the company employs 180 people.

The Perforator Production (PVA) enterprise was created in 1995. Oil and gas enterprises and mining companies currently use three main techniques for increasing their extraction output, that is, pumping liquid into the productive underground layers to squeeze out material to be extracted, creating artificial seismic effects, and perforating drill holes with explosive or electromechanical devices. The latter is now the most widely used, both because it is superior from an environmental standpoint and because it is less costly in technical and labor terms.

Two perforator types—solid encased and with ribbon-shaped charges—are intended for the secondary opening of productive layers in vertical, slanted, horizontal, horizontally branched, and sharply distorted open-face oil and gas wells.

PVA's customers include both Russian firms and companies from nearby foreign countries (Azerbaijan and Kazakhstan). The company currently employs about 140 people.

PSIMVT is an enterprise that performs explosive welding of bimetallic and multilayer materials. Developed at VNIIEF, this technology makes it possible to weld any metals and alloys, with the strength of the weld along the entire contact surface being as strong as the mechanical strength of the precursors. Practically any combination of metals may be used as precursors as long as they are 0.5 to 10 millimeters thick with a surface area of 0.1 to 5 square meters. The compositions produced may be cut, flexed, rolled, stamped, welded, and so on.

The pulsed welding technique is suited to the types of parts and the industries where previous methods of joining different types of materials were not always successful. Conventional welding based on melting entails great difficulties that are exacerbated by significant differences in the physical properties of the materials being welded. Joining different types of metals mechanically (using bolts and rivets) does not always produce reliable high-quality structures. The new explosive welding technique eliminates all these drawbacks. Conditions produced in solid phase welding (plating) are far more favorable for successfully joining different types of metals, thus substantially reducing the high temperature effect on the materials that is characteristic of the majority of melt welding methods.

Bimetallic articles are remarkable for the following characteristics:

- the high strength of the weld over the entire contact surface (not less than that of the metals welded together)
- the large number of layers that can be included (up to 50)
- improved physical and chemical properties
- increased rigidity
- cost efficiency

Bimetallic articles are suitable for various applications and may differ in size, configuration, number of welded layers, materials used, and other customer-tailored characteristics. The customers for these products are Russian companies as well as firms from Finland, Chile, and Canada. At present the facility employs 70 people.

Thus, from the aforementioned examples, it is obvious that foreign partners may effectively act as investors or customers.

If the decision is made that cooperation should be pursued and that investments would be appropriate, the average investment of a foreign partner in a small innovative firm in Sarov is $200,000. As a rule the money invested goes into the main assets of the company. It should be mentioned that almost every project mentioned was cofinanced by the Russian side (the Russian Ministry of Atomic Energy [Minatom], the Fund for the Development of Conversion Enterprises, the Sarov city budget). Foreign investors commonly stress the importance of cofinancing, sometimes even making it a necessary condition of their involvement.

One motivating factor in resolving financing issues for projects in Sarov is the desire to develop and accelerate the defense conversion process at VNIIEF and Avangard. In addition, there is a need to create companies that would benefit from scientific and technical potential of VNIIEF and carry out the necessary work at a lower cost than at foreign firms.

As for customer-oriented collaboration, typical orders bring in from $10,000 to $300,000. The quality of the products or services is an important element in guaranteeing regular orders in the future. In this regard,

companies in Sarov, as well as elsewhere in Russia, must resolve the problem of getting their products certified according to international ISO-9000 standards (Titan, for example).

A foreign partner may also render consulting services in addition to the basic focus of the contract.

Several points on successes and difficulties in working with foreign partners should be mentioned. Success depends upon such factors as

- strong foreign customer
- not much funding required to develop a prototype
- pre-assembled staff with a good amount of scientific-technical work already complete

Difficulties and subsequent slow growth are caused by the following factors:

- major expenses for marketing and seeking real partners, especially in the Western market
- lack of funding for relatively expensive intellectual property protection in the Western market
- obligatory certification in compliance with Western standards
- unfair competition

Let us analyze the successes and difficulties encountered by the aforementioned companies in their work with foreign partners (see Table 1).

Following are the most important lessons learned by the aforementioned companies:

1. Financial management problems may occur. All of the firms encountered these difficulties, which explain the long developmental stages of ABP and Perforators Production before they reached the break-even point.
2. Orders can be irregular, even if a foreign partner exists. The Titan plant faced this problem, which leads to inefficient operations and a lack of cash flow. This is why the company is active in the Russian market as well, where the orders are not so lucrative but more stable.
3. Difficulties associated with market research can arise. This is an issue for all companies that lack strong customers.
4. Certification under international standards and protection of intellectual property rights abroad can be complicated.
5. Access to funding may be difficult. For example, two and a half years passed from the time the foreign partner decided to finance the laparoscopy and telemedicine projects until the time the investments were actually received, even though there was cofinancing from the Russian

TABLE 1 Successes and Difficulties Faced by Sarov Companies in Dealing with Foreign Partners

Company	Successes	Difficulties	Developmental Stage
Rehabilitation Center	Attraction of foreign investors	Commercialization	Past investment stage; not yet self-sustaining
Titan	Orders of foreign customers	ISO-9000 certification, market study, unfair competition	Past investment stage; near break-even point
OCC	Attraction of foreign investors	Market study, intellectual property protection in Western market	Past investment stage; not yet at break-even
VNIIEF-STL	Strong foreign customer	Intellectual property protection in Western market	Past investment stage; self-sustaining
ABP	Strong foreign customer/investor	Market expansion, turnover capital required, unfair competition	Past investment stage; self-sustaining
Perforators	Foreign customer	Market expansion	Past investment stage; self-sustaining
PSIMIVT	Foreign customer	Market expansion	Investment stage close to completion; sales started

side. In addition, standard bank loans are unavailable for companies in the investment stage.

Today we have sufficient practical experience working with foreign investors and customers that we are in a position to create new firms. However, in our view, this process also requires the support of international funds and foundations for the closed administrative-territorial zones.

The Role of Nongovernmental Approaches to Business Development

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Rotary was established in the early part of the twentieth century by Paul Harris in Evanston, Illinois, as an organization to bring leaders from the business community together to share fellowship, friendship, and business strategies through the ideal of community service, that is, "Service Above Self." Rotary has grown to be an international organization, operating in more than 90 countries worldwide. It contributes to projects ranging from polio eradication to fellowships for graduate students in peace negotiation and conflict resolution to group study exchanges bringing together business leaders from different countries to share strategies for business development and growth. All of these efforts are supported through private contributions and foundation monies raised from the members, not through any governmental support programs.

We, the communities of Livermore and Snezhinsk, have been working to bring Rotary to Snezhinsk, as an outgrowth of our sister city relationship. Livermore and Snezhinsk are the third U.S.-Russian nuclear sister city pair. Obninsk and Oak Ridge, Tennessee, and Sarov and Los Alamos, New Mexico, have been sister cities since the mid-1990s. Livermore and Snezhinsk officially became sister cities in 1998. The objective of our project was to work with the city officials and business personnel in the city of Snezhinsk to establish a Rotary Club, promoting community service and service to youth in Snezhinsk. This effort was launched at the request of the Russian side and was included in an agreement signed by Mayor Oplanchuk and Mayor Cathie Brown in 1998, with the project to be implemented through the organization Women of ZATO (Closed Administrative-Territorial Zones) and the newly formed Snezhinsk Club

of Social Initiatives. Also involved in the project was the Livermore Rotary Club, whose members were to help the group in Snezhinsk to charter a new Rotary Club in their city. Community service is a cornerstone of Rotary, and citizens in both cities support the concept of promoting community service through the organization. Rotary is an international service organization that provides linkages for its members, leaders in their respective business communities, to the greater professional community worldwide. We, in both cities, believe that Rotary will serve as the cornerstone to foster greater relationship between the youth of both cities, as well as a foundation for other municipal activities.

In addition to forming the Rotary Club, we worked with the Women of ZATO to develop and deliver women's leadership and entrepreneurship training. Women in Russia, and in particular in the nuclear closed cities and the scientific community, have not had the opportunity to participate in leadership opportunities, either in the community or in the workplace. However, with the expected changing employment situation in the city of Snezhinsk, specifically the transition of workers from the Federal Nuclear Center to the private sector, there will be a great need for people, and particularly women, who are typically underserved, to be prepared for the transition. We envision that both efforts will encourage the citizens of Snezhinsk to help develop, strengthen, contribute to, and utilize local community resources to improve their quality of life and promote community stability.

It is important to understand that Rotary is not a missionary organization. In addition, the Russian Consul General in Seattle has stated that the Russian government supports the extension of Rotary into Russia, as they support the organization's ideals, believe in the goal of community service, and feel that Rotary will promote business exchange and understanding.

Sponsoring a new club requires approximately two or three years of effort. A Russian charter club president needs to be identified and a Russian city club needs to be selected for cosponsorship. Of course, e-mail is most helpful in this regard. In the past, U.S. clubs have sponsored their Russian counterpart presidents to attend district conferences as a way of getting better acquainted with the organization and its operations.

The next steps include identifying a friendship group, establishing a regular time and place for meetings, and registering the organization legally with the Russian government. Regular meetings should be held with new members to review the manual and related procedures. Sponsor training is also helpful in this regard. A club should have at least 20 members to be effective, and it also needs a worthy project on which to focus its efforts. Youth exchanges are one possible idea.

In the next stage the new club should develop a three-year plan, identifying key activities and setting deadlines for accomplishing them.

The plan should also aid in club fundraising efforts, possibly involving attracting local sponsors. Approximately $35 per year per member is needed, or about $3,000 per year total. These funds are used to send club presidents to conferences and to purchase books, pins, banners, a bell, and office supplies. Possible fundraising ideas include selling Russian arts and crafts, promoting tours, or holding children's art competitions or other events. A Rotary grant could be used for a particular project, and U.S. counterparts could provide advice on funding sources and help to develop plans for future joint projects.

Unfortunately, Rotary is still viewed in some circles in Russia as a "trade organization," when it really should be considered a "humanitarian organization." In addition steps need to be taken to ensure that the Snezhinsk Rotary Club is considered a charitable organization and thus has tax-free status. Any equipment being shipped for projects should be labeled as humanitarian supplies, with the local customs office alerted ahead of time.

We have achieved our objectives for this project and are proud to say that joint activities and projects for the upcoming year have been planned and are well under way, including the first youth exchange between Livermore and Snezhinsk, which is set for the late summer of 2001. The Snezhinsk Rotary Club is ready to be chartered (formal completion is expected in the fall of 2001). The Snezhinsk Rotary Club has established a leadership team and meets weekly. The new club is being mentored by both the Livermore Rotary Club and the Yekaterinburg Rotary Club, and the Yekaterinburg club has expressed strong interest in developing joint projects in the Urals, serving those in need in the region. In addition, the Yekaterinburg club was so excited by the leadership training provided by the team from Livermore in Snezhinsk that they have asked for similar training to be provided to their club and community.

The membership of the Snezhinsk club has grown from a core of 10 members in June 2000 to 24 members today. The club has diversified its membership from only 20 percent men to nearly 35 percent men. The city administration is supportive of their efforts. Finally, they have completed writing their formal charter and during the leadership workshop in January–February 2001, they finished their strategic plan as well as action plans for their first project. This is tremendous progress, and we are all proud to be partners in this effort.

Both communities have expressed strong commitment to this collaboration, as have the other social organizations in Snezhinsk that were brought in as partners through the leadership training to support the new Rotary Club.

The final activity for this project was the visit to Snezhinsk by a team from Livermore to conduct a leadership workshop for the Rotary Club

and other social organizations in the city, with a special emphasis on women's leadership in the community. Though the visit was postponed twice during the fall of 2000, the trip finally occurred from January 29 through February 6, 2001. Members of the team included Cathie Brown, the mayor of Livemore; John Shirley, former Livermore mayor, retired veterinarian, decorated World War II veteran, community business leader, and Rotary Club past president; Susan Gallinger, director of library services for the City of Livermore and Rotary past president; Lori Garcy, Livermore school superintendent and Rotary past president; Ladonna Robson, management consultant and workshop leader (and soon a member of the Livermore Rotary Club); and Eileen Vergino, Livermore Rotary Club member, Snezhinsk Rotary Committee chair, and board member of the Livermore-Snezhinsk Sister City Organization. Eileen was accompanied by her son, Adam Vergino, who served as the first student from Livermore to visit Snezhinsk. In addition to conducting the workshop, the visitors solidified the sister city relationship, planned future joint projects, and built new bridges of understanding between the schools, libraries, and veterans of the two communities.

Attending the workshop were 50 community leaders—40 women and 10 men—representing 12 community social organizations, along with representatives of the mayor's office and the charter president of the Yekaterinburg Rotary Club, Ibadulla Satybalov. Nearly one-half of the participants were from the Snezhinsk Rotary Club, and all 50 participants remained with the workshop for the entire four days of training. The purpose of the workshop was to bring together these disparate groups to identify the key community needs and goals as well as strategies for addressing these issues through Rotary (i.e., the private sector, rather than seeking resolution through governmental support). Next, participants strove to build consensus on the vision and mission of the Rotary Club for addressing these community concerns, establish a community constituency through collaboration among the varied community groups, consolidate community leadership, and, finally, unite the groups to work together on addressing community issues. This was an enormous task, yet even with the language barrier and some initial concerns voiced over turf, the group worked together and developed a shared vision, mission (adopting the Rotary International mission), values, and goals.

VISION

Snezhinsk Rotary is a club of trusted, dedicated, influential people supportive of the Rotary ideals who solve the problems of the city community through cooperation with nongovernmental, business, and government sectors in their personal, professional, and community life.

MISSION

The mission of Rotary is to encourage and foster the ideal of service as a basis of worthy enterprise and, in particular, to encourage and foster

- the development of acquaintance as an opportunity for service
- high ethical standards in business and the professions, the recognition of the worthiness of all useful occupations, and the dignifying of each Rotarian's occupation as an opportunity to serve society
- the application of the ideal of service in each Rotarian's personal, business, and community life
- the advancement of international understanding, goodwill, and peace through a world fellowship of business and professional persons united in the ideal of service

VALUES

Rotary is designed to help other people with responsibility and honesty who are committed to the goals of the organization. It values the ability to work in teams, listen to others, display flexibility, come to consensus, and exchange information freely. Rotary recognizes the ability of every member to give power to the club. Its members get great pleasure from working together. Every member observes ethics and recognizes the abilities of others.

The principles of the organization are to reward and encourage

- personal growth
- useful initiatives
- application of knowledge and personal experience
- growth of competency
- learning
- increase of image
- charity work for/from all
- personal charity

GOALS

The following top-priority goals were set by the Snezhinsk Rotary:

1. youth
2. the elderly
3. health
4. international linkages
5. management

6. unificiation with and assistance to all community service organizations in the Snezhinsk community

The club went a long way towards developing action plans for at least three of the goals. First, the action plan for youth exchange is already under way, and there are currently two exchange students funded by the Livermore Rotary Club who arrived in Livermore on August 20, 2001, and will be staying with families in the community through June 2002. While in Snezhinsk, we met with more than 20 youth in the community, and they expressed interest in both youth exchange and development of an Interact (youth Rotary) club. Such a club would foster the expansion of community service from the adults in the community to the youth and build a bridge between the business community and youth, the future of these communities. Second, through the leadership workshop, a bridge was built between the Rotary Club and the other community organizations, and all have committed to working together rather than continuing to compete for scarce resources.

Action plans were developed for joint projects as a direct result of the leadership workshop held in Snezhinsk. These plans lay out our joint plans for youth exchange, joint fundraising, and membership recruitment. Members from the Snezhinsk Rotary Club, Livermore Rotary Club, and Yekaterinburg Rotary Club who have been assigned to the action plans have already begun their work. To support the joint projects, the Livermore Rotary Club has been auctioning craft items provided by the Snezhinsk Rotary Club. To date, more than $1,500 has been raised. Finally, the Yekaterinburg Rotary Club and the Snezhinsk Rotary Club have agreed to work together on joint recruiting strategies and communication of their successes.

It was energizing and gratifying for the American team to have the opportunity to participate, as the Snezhinsk Rotary Club was empowered to serve as the unifying nongovernmental organization that will play a central role in helping to prioritize and seek resolution through nongovernmental support for key social issues in the community. It was especially rewarding to watch the emergence of the Snezhinsk Rotary leadership in the community and to help enable this to occur. Two Rotary meetings were held, one with the current members of the Rotary Club and another with the Businessmen's Club for the purpose of recruiting new members. The three Livermore Rotary past presidents participating as part of the delegation (including a former mayor and retired veterinarian, the school superintendent, and head librarian) did an outstanding job of describing the value Rotary brings to the business community and the entire local community as a whole. At least six members of the Businessmen's Club expressed interest in joining the new Rotary Club.

However, it is not all a good news story: The Livermore and Snezhinsk Rotary Clubs were partnering together to acquire neonatal monitoring equipment for the hospital in Snezhinsk, which a joint U.S.-Russian medical team had identified as a community need. This project required that the Snezhinsk Rotary Club complete their formal chartering process. As of February 1, 2001, two cardiac monitoring units for the hospital in Snezhinsk were received: one for pregnant women and one for infants. Both six-bed units are served by state-of-the-art central monitoring stations. The cost of refurbishing, installing, calibrating, and purchasing the first supplies to operate the two units comes to approximately $40,000. Added to the approximately $9,000 cost of shipping the equipment to Snezhinsk, the total cost of the project is around $49,000. We had already begun the fundraising necessary to accomplish this project (including pursuing a matching grant with Rotary International), with the Livermore Rotary Club working to raise approximately one-fourth of the $49,000, or $12,250. The new Snezhinsk Rotary Club is working (with help from the Livermore Rotary Club) to raise approximately $1,000, and $9,000 has been committed from another source. However, because of the inability of the medical team to receive Minatom authorization to visit the city of Snezhinsk, not as nuclear tourists, but as members of an assessment team, this equipment has been lost for at least one year, and possibly permanently.

What are the key points to highlight from our experience?

- This partnership was made possible by support from the Snezhinsk City Administration and the commitment of a leadership team within the city of Snezhinsk that supports this effort.
- This effort is one mechanism that allows the community to leverage support from the business community to address community social needs while also providing support to the business community itself, that is, networking opportunities.
- We heard a good deal about the need to target youth and link to youth in the communities, and this is one way to do just that.
- Internship opportunities through the private sector are both supported and encouraged.
- No government financing is required, just concurrence.
- These programs are independent of the whim and whimsy of governmental funding and require only the commitment of the communities.
- In the end, building a stronger social sector can only strengthen business and the environment for business to grow.
- It's about people!

Small Innovative Business in the Nuclear Cities

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As highlighted in government documents such as the comprehensive program for the development and state support of innovative business, the regulation of innovation-oriented processes is subordinate to tasks of preserving scientific-technical potential and mobilizing it for the structural reorganization of the economy.

The formation of market relations in the scientific-technical sphere is carried out through the following actions:

- supporting and developing the infrastructure for innovative business
- encouraging competition by attracting financial resources and using them in a focused and efficient manner to implement innovation programs and projects aimed at creating capacities for the production of science-intensive products

To these ends, measures are being carried out at the regional and industry levels aimed at

- increasing innovation activity in the scientific-technical and industrial spheres
- promoting qualitative changes in the organizational structures of these sectors

[*] Translated from the Russian by Kelly Robbins.

- increasing the innovation-oriented returns derived from research efforts
- creating additional funding sources for science
- fostering a competitive environment
- filling the market with goods and services
- increasing employment opportunities for the population by attracting laid-off scientific personnel to the innovative business sector
- developing a system of services for the innovation sphere

The role of the state lies in creating the following elements:

- favorable conditions for entrepreneurial innovation activity through the concentration of small amounts of resources in points of growth
  - ♦ science and technology parks
  - ♦ innovation centers
  - ♦ business incubators
- special legal and regulatory acts aimed at supporting activity in the scientific-technical services sphere

Unfortunately support programs have remained only on paper. Matters have not yet reached the point of radical reform of the scientific-technical sphere (the formation of joint-stock companies), a situation that can be considered an unrealized opportunity. Without the widespread practice of establishing participatory stock-based ventures in the scientific-technical sphere, the problem of the development of innovation-oriented business takes on great urgency.

The nuclear cities provide a cross-section view of the high-tech sphere in general. The cities of the Russian Ministry of Atomic Energy (Minatom) have accumulated a great deal of scientific-technical potential supported by a powerful industrial base and an enormous amount of operational experience in areas requiring specific knowledge and skills. With the new economic reforms, these cities have faced a serious problem:

- how to use their potential effectively
- how to form successfully operating businesses on the basis of the innovative technologies they have produced
- how to provide employment for the highly skilled workers who have lost their jobs at the main defense enterprises as a result of cuts in defense orders and the diversification of the firms' activities

The situation in the closed nuclear cities has essentially been no less harsh than in other science- and technology-oriented cities (science cities).

About 10,000 Obninsk residents work outside the city, and science has served as a donor promoting economic development not only for the city but also for the region in general.

Minatom pursues a targeted policy of promoting major defense conversion activities and implementing large projects. This policy is aimed at supporting conversion and enterprise restructuring and reducing and subsequently eliminating defense-related activities. This policy is well justified. To achieve results within an optimal period of time, Minatom must focus on carrying out just such major projects that are directly oriented towards conversion and associated with the primary activity of the enterprises.

However, insufficient attention is being paid to the conversion activities that may be small in scope but might result in very successful businesses based on high technologies developed at the enterprises.

Following are several objective preconditions for the development of small innovative business in the nuclear cities:

1. the great amount of scientific-technical potential amassed during the operations of the main enterprises in these cities

   - developments in various fields of science and engineering
   - highly professional engineers and scientists
   - well-organized industrial base

2. a well-developed system for professional training
3. a well-developed financial infrastructure
4. good social welfare conditions for city residents. City budget expenditures per resident are several times higher than in nearby regions, and the social protection system is operating.
5. acceptable living conditions. Public utilities and other elements of the urban infrastructure are maintained at a good level. Work is constantly being done to repair and renovate utility lines, plant and maintain trees, and otherwise clean and beautify the city. There is a well-established intra- and intercity transportation system, and the telephone system is well developed. Residents of the cities never face the problem of having their water or power supplies switched off.

The task of the city administrations and the enterprises lies in utilizing this potential and creating successfully operating businesses on the basis of innovative technologies and products. Despite the lack of favorable conditions for bringing innovation potential to bear, this process is beginning to become active, as directly confirmed by the examples cited. In addition, the examples also illustrate that much depends on efforts and initiatives at the local level.

In each of the nuclear cities, dozens of science-intensive conversion projects have been carried out at the city-forming enterprises. Small innovative businesses are not yet making a defining contribution to the economy of these cities, but their impact is beginning to be felt. Figures for small business-related employment, high-tech production output, and tax revenues have already climbed far above the single digits as percentages of overall indicators for the research and production sector as a whole.

The city-forming enterprises play a very significant role in developing small high-tech businesses. For example, this is illustrated by the activities of VNIIEF-Conversion, an open joint-stock company founded by the Russian Federal Nuclear Center–Scientific-Research Institute of Experimental Physics (VNIIEF) in cooperation with Minatom and the Sarov City Administration. VNIIEF-Conversion is a sort of holding company that manages conversion projects that have evolved to the point of operating as independent legal entities.

A great deal of focused work is being done in the closed nuclear cities and substantial experience has been accumulated regarding support for the development of small innovative businesses. Such development measures may be divided somewhat conditionally into three groups:

1. Normative:

- development of programs to support small innovative businesses
- various types of activities
- resolutions on investment activity

2. Financial:

- investment zone (Zheleznogorsk)
- funds and foundations (municipal, nongovernmental, etc.)
- tax incentives
- use of lines of credit
- venture capital activity (Zarechny, at the regional level), and so forth

3. Organizational:

- international support programs (Nuclear Cities, Tacis, etc.)
- creation of an infrastructure for innovation activity (technoparks, business incubators, industrial zones)
- training and professional development programs
- exchanges of operational experience (conferences, seminars, etc.).

The difficult and unstable nature of the economic and political situation, the crisis phenomena in the Russian economy, and the long and drawn out economic reform process have occasioned a number of serious problems facing the innovation business:

- There is a lack of targeted stable sources of financing for innovation projects and conversion activities. Financing of these activities is carried out unsystematically, on a case-by-case basis, mainly with money from special Minatom funds.
- There is also no mechanism for commercializing projects and creating effectively functioning enterprises on their basis. The majority of projects stall at the research and development or experimental sample stage.
- The market infrastructure is underdeveloped and consistent sources of market information are lacking.
- The legislative and regulatory base is unstable and imperfect:

  ♦ problems in the tax sphere (frequently changing rates and collection provisions), causing difficulties in predicting costs

  ♦ difficulties for innovative businesses, including commercialization of intellectual property

  ♦ hindrances to the quick and efficient development and implementation of targeted joint programs at various levels (federal and regional, interregional, regional and local, especially involving the closed administrative-territorial zones)

- The economy is highly bureaucratized, with much overlap between the authorities of government and regulatory agencies and a complex system for obtaining permits and certifications.
- Industrial equipment throughout the country is substantially obsolete and physically deteriorated.
- Russia and its various regions have low investment appeal. Foreign investors are extremely reluctant to invest in new fields of activity, especially in the regions.
- There are not enough experts able to meet current market demands (marketing, analysis of current market conditions, development of marketing strategies, sales, and midlevel management).
- The communications infrastructure is outdated and of poor quality.
- The structural units manufacturing high-tech products lack independence and are in need of restructuring.

In the course of carrying out innovation projects, individual enterprises encounter a large number of very specific problems, the most ur-

gent of which is that of obtaining investments in the necessary amount and for the necessary duration. Even today the Russian banking system offers unfavorable loan conditions for the implementation of investment projects:

- high interest rates
- no system of long-term investment loans with reduced servicing requirements
- impossible collateral requirements

How should the strategy for developing small innovative businesses be approached?

1. the targeted program approach (focused on scientific-technical development priorities)
2. selective support (competitive selection)
3. market regulation (orientation to solvent demand)

What role should be played by regulation at the federal, regional, and industry levels? Innovation strategy within each industry should be designed with an eye to

- setting technological development priorities in order to determine the areas that should receive priority financing
- creating an intellectual and informational infrastructure for innovation project design
- creating conditions for the development of innovation-oriented management
- updating the legislative base for the innovation sphere
- restructuring the scientific sphere with special focus on the innovation sector and the search for the most effective projects

The fact that innovation activity involves representatives of various specialties and various government agencies complicates coordination efforts. It seems that creating a working group ("brain center") could accelerate the process of creating a strategy for the development of small innovative businesses, including the following:

- principles for the restructuring of the science sector
- measures for intensifying innovation activity at the intersection of science and industry
- sources of financing

A systematic analysis of the information contained in reports presented at this seminar specifies steps that seem necessary for the development of innovation activity in the nuclear cities:

1. Innovation activity should be supported at the federal level, including passage of a federal law and accompanying regulations governing innovation processes. A mechanism for the implementation of state innovation policy should also be created.
2. A focused policy is needed for maintaining and stimulating the development of innovative technologies and products developed at the city-forming enterprises. These projects should be developed separately but with the active participation of the base enterprises, which provide the premises, equipment, and specialists. Minatom should provide targeted support and incentives.
3. The innovation infrastructure, including technology incubators, technoparks, and innovation zones, requires targeted support and development. Such structures should be provided with special tax incentives.
4. Targeted investment funds should be created with support from the federal budget (Minatom) for the development of small conversion-oriented and innovative activities. Procedures for obtaining support from these funds should be simplified. Financing should be of a strictly focused nature with investment results to be closely monitored.
5. Innovation-oriented venture capital funds should be established. They would participate as investors in projects involving increased risks and long recoupment periods.
6. Simplified procedures should be instituted for transferring state property into other forms of ownership, including opportunities for price reductions during the sale or leasing of property if it is connected with innovation-oriented activities. A mechanism should be developed for transferring equipment and production facilities on favorable terms if they are to be used in promising conversion-related activities.
7. An enterprise restructuring program should be developed, with separate activities to be spun off into separate independent enterprises.

Highlights of Presentations and Discussions

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We have considered a wide variety of technologies of commercial interest, from space communications systems to radioactive isotopes for health applications to food supplements. Also, we have considered different organizational forms of companies, management approaches, and marketing efforts. The experiences of technoparks that are not linked to Minatom facilities have helped broaden the discussion, and the geographical and historical differences in the cities that were represented have helped us appreciate the pitfalls inherent in making generalized statements about the reasons for successful and unsuccessful commercial activities.

I was very pleased by the broad interest in educational issues, in terms of both linking higher education facilities to industrial activities and establishing new types of curricula for the preparation of a new generation of scientific entrepreneurs. The youth are the managers of tomorrow, and there is a serious need for stimulating greater interest among young scientists and engineers in innovating for profit to help offset common tendencies for well-trained technical specialists to seek jobs as traders and bankers.

While efforts to create new job opportunities have apparently been modestly successful in the nuclear cities during the past two years, we were warned of likely large-scale unemployment during the next several years as Minatom begins implementing its plans for downsizing the weapons complex. Unemployment is in many ways the overriding challenge that should encourage greater attention to the creation and expansion of small innovative firms. At the same time, we learned that the Minatom

conversion program, which has funding of about $80 million annually, was having difficulty attracting good proposals from within the Minatom complex. Of special concern is the lack of attention to the development of long-term customer bases in parallel with the development of new or improved commercial technologies.

The overall status of the economy is obviously important in determining the likely success of small firms. In recent months the economic indicators for Russia show that the situation has stabilized and is indeed improving. Clearly, increased world prices for oil have been a major factor in this gradual turnaround. As to the future, there is no reason to believe now that the situation will soon deteriorate.

There was a consensus that technoparks can provide important pathways for marketing the products of research activities. While the position of each firm is rather unique, two general principles concerning technoparks emerged. First, technoparks should have the capacity to expand as new firms are born and old firms find new customers. Second, technoparks should only accept firms that have a reasonable chance for market success. While technoparks can provide secure space, communications infrastructure, and sometimes advisory services, they cannot change the basic technical capabilities and customer orientation of a firm.

Tensions that exist within Russia concerning privatization of technological activities that have roots in government facilities were apparent during the discussions. Many officials and managers within the Minatom complex seem to believe that technologies developed within a Minatom facility should be commercialized by the facility and not handed off to a private firm that has its own profit motivations. Others argue that only through privatization efforts will technologies be brought to the marketplace at an affordable cost without the benefit of government subsidies. Two approaches were cited in attempting to reduce this tension. In Sarov, the All-Russian Scientific-Research Institute of Experimental Physics (VNIIEF) has established a daughter company that serves as a holding company for several granddaughter companies, with VNIIEF retaining from 10 to 80 percent ownership interest in the latter firms. In Obninsk, the Institute for Physics and Power Engineering (IPPE) has spun off technologies to private firms with negotiated agreements concerning compensation to IPPE for its technological contributions. An assessment of the successes of these approaches would seem appropriate.

Another area of major concern was the almost exclusive focus of both the Russian research institutes and the Department of Energy programs on "technology push," whereby technologies are developed and then customers are sought. No examples were cited of the research institutes responding to "market pull," or indeed of even consulting with potential customers prior to developing technologies intended for the commercial marketplace. However, the three small innovative firms the Western

participants visited in Obninsk in connection with the workshop seemed well linked to potential customers, even though they had initiated their activities through a technology push orientation.

There is one final concern related to efforts to attract foreign partners in the nuclear cities. Zarechny scientists have had considerable success in this regard, widely marketing inert gases and related analytical technologies. As to foreign investment, only Obninsk has managed to attract Western partners that have made significant investments in Russia. While Russian institutes and firms in all of the cities have received grants and contracts from Western organizations, the economic impact of these arrangements beyond providing income for a limited number of participants is small. Only when investment leads to production in Russia, as is the case in Obninsk and Zarechny, will there be significant economic impact. Also of concern is the relatively short duration of grants and contracts from abroad, which does not augur well for sustainability.

The small business sector is still in its early stage in Russia. Nevertheless, there are a sufficient number of commercially viable innovative activities with production in Russia to indicate that this sector should play an ever-increasing role in accelerating economic growth on both a local and national basis.

Appendix A

Committee Members and Participants

COMMITTEE MEMBERS

Dr. Alvin W. Trivelpiece (*chair)* was formerly Director of Oak Ridge National Laboratory (ORNL) (January 1989–March 2000). Since May 2000 Dr. Trivelpiece has been a consultant to Sandia National Laboratories. In January 1996 he was appointed President of Lockheed Martin Energy Research Corporation, the managing and operating contractor for ORNL. Dr. Trivelpiece served as the executive officer of the American Association for the Advancement of Science (AAAS) from April 1987 to January 1989. He came to the AAAS from the U.S. Department of Energy, where he served as the director of the Office of Energy Research from 1981 to 1987. Dr. Trivelpiece was head of the 1986 U.S. Delegation on Peaceful Uses of Atomic Energy to the USSR. While on leave from the University of Maryland, from 1973 to 1975, where he was a professor of physics, he served with the U.S. Atomic Energy Commission as assistant director for research in the Division of Controlled Thermonuclear Research. A native Californian, he received his B.S. degree from California Polytechnic State University in 1953, and his M.S. (in 1955) and Ph.D. degrees (in 1958) from the California Institute of Technology. He was a member of the Board of Directors of Bausch & Lomb, Inc. from 1989 to 2001 and of Charles River Laboratories from 1992 to 1999. He was elected to the National Academy of Engineering in 1993. He recently served on the National Academies Review of Technical Issues Related to Ratification of the Comprehensive Test Ban Treaty (July 1, 2000–October 31, 2001). He

has also served on the National Academies Committee on Science and Technology Policy Aspects of Selected Social and Economic Issues in Russia (November 1, 1999–November 10, 2000) and other National Academies committees. His research has focused on plasma physics, controlled thermonuclear research, and particle accelerators. He was granted several patents on accelerators and microwave devices and is the author or co-author of two books and many papers. He also serves as an advisor to various government agencies. In addition to involvement in several other scientific organizations, he is a fellow of the APS, the IEEE, and the AAAS and is a member of the American Nuclear Society.

Ms. Eileen S. Vergino is Deputy Director of the Center for Global Security Research (CGSR) at Lawrence Livermore National Laboratory (LLNL), a position she has held since 1999. She is responsible for developing and implementing new collaborations between CGSR and outside entities. Additionally, Ms. Vergino oversees community development activities with the city of Snezhinsk as part of the Nuclear Cities Initiative, and she has been instrumental in establishing the Sister City relationship between the cities of Livermore and Snezhinsk. From the time of the center's establishment in 1996 until 1999, she held the position of special assistant to the director of CGSR. She has served as the primary contact and science advisor representing LLNL with the U.S. Department of State for the International Science and Technology Center and the Science and Technology Center of the Ukraine. Ms. Vergino is the former Director of Education Programs at LLNL. She also worked for over 16 years as a seismologist in the LLNL Treaty Verification Program. During this time she published numerous papers on seismic yield estimation and discrimination studies. Additionally, she was the manager for Information Management and Computational Support within the Treaty Verification Program. Ms. Vergino earned her B.S. in Geophysics from the Massachusetts Institute of Technology.

Dr. Clifford G. Gaddy is a Fellow of the Economic Studies and Foreign Policy Studies programs at the Brookings Institution. Dr. Gaddy's expertise is in the Russian economy, and his current project at Brookings deals with the long-term outlook for the Russian economy and its implications for U.S. policy. He has served as a visiting professor of economics at Johns Hopkins University and an adjunct professor at the Center for Eurasian, Russian, and East European Studies (CERES), Georgetown University. Dr. Gaddy was formerly a research associate for the Berkeley-Duke Project on the Second Economy of the USSR. He has also served as a translator of several languages, including Russian and German. He received his B.A. from Wake Forest University in 1968 and his Ph.D. from Duke University in 1991. Dr. Gaddy has published many works on the

Russian economy, including a 1996 book entitled *The Price of the Past: Russia's Struggle with the Legacy of a Militarized Economy*. Dr. Gaddy has served on two National Academies committees, the Committee on Science and Technology Policy Aspects of Selected Social and Economic Issues in Russia (November 1, 1999–November 10, 2000) and the Committee on Microeconomics and Enterprise in a Market Economy Under Defense Conversion (October 22, 1992–December 31, 1993).

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Anatoly Vasilievich Zrodnikov, Director General, Russian Federal Nuclear Center—Institute for Physics and Power Engineering (IPPE)

Appendix B

Russian Science Cities

(City name followed by alternate name, if any, and oblast name)

Biysk, Altai
Krasnodar-59, Krasnodar
Zheleznogorsk (Krasnoyarsk-26), Krasnoyarsk
Zelenogorsk (Krasnoyarsk-45), Krasnoyarsk
Krasnoyarsk RAN [Russian Academy of Sciences] Science Center Akademgorodok [Academic City], Krasnodar
Mirny (Plesetsk), Arkhangelsk
Znamensk (Kapustin Yar), Astrakhan
Mepenki, Vladimir
Raduzhny, Vladimir
Irkutsk RAN Science Center Akademgorodok, Irkutsk
Obninsk, Kaluga
Gatchina, Leningrad
Primorsk, Leningrad
Sosnovy Bor, Leningrad
Zelenograd, Moscow
Balashikha, Moscow
Beloozersky, Moscow
Dzerzhinsky, Moscow
Dmitrov-7 (Avtopoligon), Moscow
Dolgoprudny, Moscow
Dubna, Moscow
Zheleznodorozhny, Moscow
Zhukovsky, Moscow
Zvyozdny Gorodok, Moscow

Istra, Moscow
Klimovsk, Moscow
Korolyov (Kaliningrad), Moscow
Krasnoarmeisk, Moscow
Krasnoznamensk (Golitsino-2), Moscow
Lytkarino, Moscow
Mendeleevo, Moscow
Obolensk, Moscow
Orevo, Moscow
Peresvet (Novostroika), Moscow
Protvino, Moscow
Pushchino, Moscow
Remmash, Moscow
Reutov, Moscow
Troitsk, Moscow
Fryazino, Moscow
Khimki, Moscow
Chernogolovka, Moscow
Yubileiny, Moscow
Dzerzhinsk, Nizhny Novgorod
Pravdinsk, Nizhny Novgorod
Sarov (Kremlev, Arzamas-16), Nizhny Novgorod
Koltsovo, Novosibirsk
Krasnoobsk (Siberian Department subordinate), Novosibirsk
Novosibirsk-49, Novosibirsk
Novosibirsk Science Center RAN Akademgorodok, Novosibirsk
Omsk-5, Omsk
Zarechny (Penza-19), Penza
Perm-6, Perm
Zarechny, Sverdlovsk
Lesnoi (Sverdlovsk-45), Sverdlovsk
Nizhnyaya Salda, Sverdlovsk
Novouralsk (Sverdlovsk-44), Sverdlovsk
Ostashkov-3, Tver
Redkino, Tver
Seversk (Tomsk-7), Tomsk
Tomsk Science Center RAN Akademgorodok, Tomsk
Dimitrovgrad, Ulyanovsk
Miass, Chelyabinsk
Ozersk (Chelyabinsk-40, Chelyabinsk-65), Chelyabinsk
Snezhinsk (Chelyabinsk-70), Chelyabinsk
Tryokhgorny (Zlatoust-36), Chelyabinsk
Ust-Katav, Chelyabinsk
Borok, Yaroslavl

Pereslavl-Zalessky, Yaroslavl
Tomilino, Moscow
Petergof, Leningrad

SOURCE: *Yezhednevnyye novosti* (Daily News) (in Russian), December 11, 2001.

NOTE: Lists of Russian Science Cities vary slightly from one publication to another.